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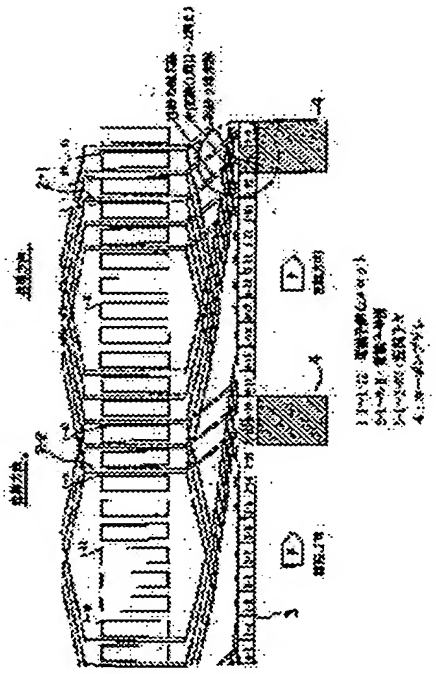
(54) COMMUTATOR MOTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a commutator motor which can improve efficiency by copper loss reduction, without making the wire diameter of an armature winding large, ensure spacing stably between the commutator hook parts, and to solve problems on quality such as fusing errors, disconnection, deformation of the hook and degradation of winding processing.
SOLUTION: The commutator motor is constituted of a rotating shaft 12, an armature core 7 with twenty-two slots 1 connected to the rotating shaft 12, a commutator 5 which has an many commutator segments 3 as slots 1 of the armature core 7, and an armature coil which is formed by connecting an armature winding 2 which is wound at least once, respectively for each pair of the slots of the armature core 7 of which each beginning of winding is placed at a symmetric position sequentially in the order with the commutator segments 3 of each neighbor, winding each armature winding 2 farther to another 22/second pair slot after 22/second pair slot winding and connecting a terminal of the armature winding 2, with the (22+1)-th commutator segment 3 counting from the beginning of winding.



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CLAIMS

[Claim(s)]
[Claim 1] A revolving shaft and the armature core with two or more slots of N connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the slot of an armature core, and the commutator segment of the same number, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding by which the coil was carried out at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment Said armature coil makes respectively sequential connection of the armature winding to which the coil of the start of a volume was carried out once [at least] to a pair each of slots which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. A coil is carried out one by one to the N/2nd opposite slots. After the N/2nd coils for a slot each armature winding -- and the commutator motor which carries out a coil one by one to the N/2nd opposite slots further, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the N+1st commutator segments, respectively.
[Claim 2] the above-mentioned commutator motor -- setting -- an armature -- all -- a conductor -- the commutator motor given in the 1st term of a claim characterized by setting up so that the ratio of a number and the number of field windings may become six or more.
[Claim 3] The commutator motor given in the 1st term of a claim characterized by setting up the phase angle of the core of said armature winding, and the core of the field pole in the above-mentioned commutator motor so that it may come among 10 degrees - 30 degrees.
[Claim 4] A revolving shaft and the armature core with two or more slots of N individual connected to the revolving shaft, The commutator which is connected to a revolving shaft and has the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core, In the commutator motor which consisted of armature coils formed in the slot of each set by making sequential connection of the termination of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots at the start edge of the armature winding by which the coil was carried out into the slot of the next pair, and the next commutator segment Said armature coil makes respectively sequential connection of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots which have the start of a volume in the position of symmetry, respectively, respectively continuously to the next commutator segment. To the N/2nd opposite slots, carry out a coil one by one and a coil is carried out one by one to the N/2nd opposite slots. after the N/2nd coils for a slot -- each armature winding -- and the commutator motor which carries out a coil one by one to the N/2nd opposite slots further, and is characterized by carrying out a coil and being formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the N+1st commutator segments, respectively.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the commutator motor used for rotating equipments, such as a vacuum cleaner and a power tool.
[0002]
[Description of the Prior Art] A commutator motor in recent years shows the inclination of small and a high increase in power, and thick wire-ization of an armature winding for the commutator motor which iron loss reduction also according [the engine-performance technical problem for which the armature used for it is asked] to a core configuration, core grade, and a board thickness improvement, and the copper loss reduction by armature-winding improvement are called for, and is used especially for a vacuum cleaner to search for a well head is advanced.
[0003] Drawing 26 For example, the coil schematics of the conventional commutator motor shown in JP,6-38704,B, The armature side elevation of the commutator motor of the former [drawing 27 / R> 7], the enlarged drawing of the partial cutting plane of the armature core slot of the commutator motor of the former [drawing 28], The commutator connection section partial enlarged drawing of the commutator motor of the former [drawing 29], drawing where drawing 30 looked at a conventional field core and a conventional armature core from the top, The armature commutator section plan of the commutator motor of the former [drawing 31], the armature commutator section side elevation of the commutator motor of the former [drawing 32], It is drawing of the coil injection section of the flyer winding machine with which the armature commutator section bottom view of the commutator motor of the former [drawing 33] and drawing 34 perform the partial enlarged drawing of drawing 33 , and drawing 35 performs an armature winding.
[0004] In 1, in drawing, 1-1--1-12 expresses the slot number with an armature core slot. An armature winding 2 is looped around into said armature core slot 1. 3 expresses a commutator segment and 3-1--3-24 expresses a commutator-segment number. 4 a commutator and 6 for a carbon brush and 5 The commutator coil connection section (henceforth "a hook"), 7 an armature core end-face insulating member and 9 for an armature core and 8 An armature core slot insulation member, The insulating member to which an armature winding holds 10 with a centrifugal force so that it may not jump out of an armature core slot For a revolving shaft and 13, as for a field winding and 20, a field core and 14 are [organic liquids and solutions, such as a varnish with which (it is hereafter called a "wedge") and 11 carry out insulating fixing of the armature winding, and 12 / the form of a winding machine and 21] the pin center,large guides of a winding machine.
[0005] Next, actuation of the conventional example is explained. A commutator 5 is alpha hook type by a diagram, and the number of commutator segments 3 shows the case where the number of 24 and the armature core slots 1 is 12. In the revolving-shaft section 12 connected with the both-ends side of the armature core slot 1 with 12 slots connected to the revolving shaft 12, and this both-ends side, the armature core end-face insulating member 8 made in resin, papers, etc., such as PET and PBT, is arranged. Moreover, inside the armature core slot 1, the armature core slot insulation member 9 made in polyester film, paper, etc. is arranged. The commutator 5 is equipped with the armature core slot 1 and the twice as many commutator segment 3 as this.
[0006] Usually, the armature winding 2 by which the coil was carried out in piles two or more times while being contained by coincidence in 1-7 and 1 -12 [the armature core slot 1-1 and 1-6, and] an armature winding 2-1 and 2-2 with two coil flyers of a winding machine Connection is carried out with twisting termination in the shape of alpha after a coil at the hook 6 of a commutator 5 (alpha-hook method). The coil of the two armature windings 2 is continuously carried out to the following armature core slot 1 with two coil flyers one by one, respectively. Twelve armature windings 2 looped around over the perimeter constitute an armature coil, and an armature is constituted so

that it may count from the start of a volume, respectively and the terminal of an armature winding 2 may be connected to the 13th commutator segment 3. Heat joining connection of said hook 6 is made with an armature winding 2 in fusing after armature connection termination, pressurizing hook 6.
[0007] However, as shown in drawing 34 , the rigidity of an armature winding 2 is strong, on both sides of hook 6, when the coil of the armature winding 2 beyond wire-size phi0.5 is carried out to the shape of alpha, since the wire size is thick, since R of the flection of an armature winding 2 ******s greatly, a conductor spacing with the ******** hook 6 cannot be secured, but poor insulation tends to happen. Moreover, since a high current flows and welding pressure also becomes strong in order to carry out heat welding compared with a thin line, in case fusing of the thick wire is carried out, they are a lifting and a cone in poor fusing and a poor open circuit. Furthermore, if a wire size becomes thick, since the rigidity of an armature winding 2 is strong, the problem that hook 6 will deform at the time of a coil will also be generated.
[0008] Moreover, as shown in drawing, when a wire size is thick, the rigidity of an armature winding 2 is strong, and since a coil tension does not fully start, either, a coil cannot be coiled with the diameter of min. There is also a possibility that the insertion tooth space of a wedge 10 may be lost by expansion of the space factor by thick-wire-izing within the armature core slot 1. Furthermore, since the coil section between a commutator 5 and the armature core slot 1 becomes large, if it flows down the varnish 11 which carries out insulating fixing of the armature winding 2, a possibility of this varnish 11 flowing into commutator 5 front face, and causing poor rectification will arise. Moreover, there is a possibility that it is necessary to inspect visually the conductor spacing after the thick wire connection in hook 6, and may be connected also with the productivity slowdown by the increment in a man day.
[0009] Moreover, it is a thing inserted in the armature core slot 1 which formed the form 20 attached in the end of the main shaft which fixed the flyer (not shown) to the position of a winding machine like drawing 35 , wound the armature winding 2 along with this form 30 and centre guide 21, and was formed in the peripheral face of an armature core 7, and an armature winding 2 is guided to the armature core slot 1 from the include angle which inclined 15 degrees **10 degrees from the pin center,large along with form 20. It was fixed to the chuck (not shown) which pinches an armature core 7, and when an armature carries out the index of such forms 20 the middle so that an armature winding 2 can be coiled to the last slot, they have established recess so that form 20 may not interfere in a coil end. Therefore, form 20 can guide an armature winding 2 only to the inlet port of the armature core slot 1, but as for the armature winding 2 which flew from the tip of form 20, slackens, and will be in a free condition in the armature core slot 1. The opening width beta of the armature core slot 1 has a possibility that an armature winding 2 may contact opening of the armature core slot 1, and may cause processing degradation, when the wire size of the armature winding 2 which it lets out from a flyer is more than phi0.5mm, since it becomes a value near beta/2 in practice with a coil injection include angle.
[0010]
[Problem(s) to be Solved by the Invention] Since the coil approach of the armature winding of the conventional commutator motor is constituted as mentioned above Although there is [a wire size of an armature winding 2] no problem in the thing of the comparatively thin wire size not more than phi0.45mm, the wire size of an armature winding 2 about the coil beyond phi0.5mm The trouble on quality -- stabilizing and securing becomes difficult and the conductor spacing in the hook 6 of an armature winding 2 has poor fusing and the open circuit to hook 6, deformation of hook 6, and a possibility that an armature winding 2 may contact opening of the armature core slot 1, and may cause processing degradation -- increases. furthermore, the evil by a wound diameter becoming large by thick wire-ization again -- happening -- in addition -- and it is necessary to inspect the conductor spacing after armature-winding connection visually, and is connected also with the productivity slowdown by the increment in a man day.
[0011] This invention was made in order to solve the above troubles, and efficient-ization of it by copper loss reduction is attained, without making the wire size of an armature winding thick. Moreover, since the 1st time and the 2nd number of winding are changeable, an input can be tuned finely. Furthermore, it is stabilized, the conductor spacing in the hook of a commutator can be secured, and poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. are aimed at offering a commutator motor which solves the trouble on quality.
[0012]
[Means for Solving the Problem] About the coil approach of the armature winding of the commutator motor of claim 1 this invention, by the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number An armature coil makes respectively sequential connection of the armature winding to which the coil of the start of a volume was carried out once [at least] to a pair each of slots

which are in the position of symmetry, respectively, respectively continuously to the next commutator segment. A coil is carried out one by one to the N/2nd opposite slots. After the N/2nd coils for a slot each armature winding -- and a coil is further carried out one by one to the N/2nd opposite slots, and a coil is carried out and it is formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the N+1st commutator segments, respectively.

[0013] By thus, the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number By coiling a coil about over the slot perimeter (duplex as a result) of an armature core, one armature winding to which the coil of the start of a volume was carried out to a pair each of slots of the armature core which is in the position of symmetry, respectively Since the coil of the two armature windings is carried out to the slot semicircle of an armature core and it becomes the same thing as winding ****** about an armature winding one-fold, For example, since the cross section equivalent to what coils an armature winding around one-fold about can be obtained by winding ****** when the wire size of an armature winding is phi0.65mm about an armature winding at a duplex when the wire size of an armature winding is phi0.45mm A thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained. Moreover, since it becomes possible if the wire size of an armature winding is less than [phi0.45mm] for it to be stabilized and to be able to secure the conductor spacing of the commutator hook section, since it is a thin line, for poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. to be able to solve the trouble on quality, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction.

[0014] the commutator motor of claim 2 of this invention -- an armature -- all -- a conductor -- it sets up so that the ratio of a number and the number of field windings may be set to more than 6:1. The spark depressor effect by transformer operation of an armature winding is improvable by making it the ratio of such a number of coils. Thus, the number of turns of an armature winding are made [many], and it becomes possible by decreasing the iron loss and copper loss of a field to make a life 1.2 times as long as before by the improvement in effectiveness, and rectification improvement.

[0015] About the commutator motor of claim 3 of this invention, the phase angle of the core of an armature winding and the core of the field pole is set up so that it may come among 10 degrees - 30 degrees. Thus, while there is little spark generating and it can control a black bar phenomenon by arranging according to the spark depressor effect by transformer operation with the next armature core slot inner lining line of a hand of cut, improvement in the life of a brush can be aimed at.

[0016] By the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core about the armature winding of the commutator motor of claim 4 of this invention An armature coil makes respectively sequential connection of the armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots which have the start of a volume in the position of symmetry, respectively, respectively continuously to the next commutator segment. To the N/2nd opposite slots, carry out a coil one by one and a coil is carried out one by one to the N/2nd opposite slots. after the N/2nd coils for a slot -- each armature winding -- and a coil is further carried out one by one to the N/2nd opposite slots, and a coil is carried out and it is formed so that it may count from the start of a volume and the terminal of an armature winding may be connected to the N+1st commutator segments, respectively.

[0017] By thus, the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core By coiling a coil about over the slot perimeter (it being an integral multiple pile to the number of slots as a result) of an armature core, one armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots of the armature core which has the start of a volume in the position of symmetry, respectively Since the number of slots serves as a 1-/integral multiple of the number of commutator segments and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core about one armature winding substantially, An engine-performance improvement effect and the effectiveness by the productivity drive can be acquired like the 1 slot-1 segment method stated by claim 1.

[0018]

[Embodiment of the Invention] One or less gestalt of implementation of invention and the gestalt 1 of

implementation of this invention are explained about drawing. The coil schematics of a commutator motor with which drawing 1 expresses the gestalt 1 of implementation of this invention, and drawing 2 are [a commutator connection side elevation and drawing 4 of the armature commutator section plan of a commutator motor and drawing 3] the commutator connection section partial enlarged drawings of a commutator motor. In drawing, 1 expresses an armature core slot and 1-1--1-22 expresses the slot number. Into the armature winding and said armature core slot 1, it was equipped with the armature winding one by one, and 2 illustrated an armature winding 2-1 and 2-2 to drawing 1 . 3 expresses a commutator segment and 3-1--3-22 expresses the number of a commutator segment. Organic solvents, such as a hook a commutator and whose 6 4 is the commutator connection sections as for a carbon brush and 5, a wedge whose 7 is an armature core and an insulating member held so that an armature core slot insulation member may not jump out of an armature core end-face insulating member and 9 with a centrifugal force and an armature winding may not jump out [slot / armature core] from 8 of 10, and a varnish with which 11 carries out insulating fixing of the armature winding, and 12 are revolving shafts.

[0019] Next, the coil gestalt of an armature coil is explained. As shown in drawing 4 from drawing 1 , the number of commutator segments 3 is the case (this is called "1 slot-1 segment method") where the number of 22 and the armature core slots 1 is 22. With a winding machine with two coil flyers, the start of a volume starts a coil for the armature winding 2-1 which is in the position of symmetry, respectively, and 2-2 to coincidence. The start of a volume connects with a commutator segment 3-1, and is looped around in a slot 1-1 and 1 -10, and a volume end connects an armature winding 2-1 to a commutator segment 3-2. The start of a volume connects with a commutator segment 3-12, and is looped around in a slot 1-12 and 1 -21, and a volume end connects another armature winding 2-2 to a commutator segment 3-13.

[0020] Hereafter, it loops around over the semicircle of the armature core slot 1 similarly, and a volume end is looped around in a slot 1-12 and 1 -21 by not cutting in the terminal after a commutator segment 3-12 and the volume end of an armature winding 2-2 connecting with a commutator segment 3-1, and a volume end connects each armature winding 2-1 to a commutator segment 3-13 for an armature winding 2-1. Moreover, an armature winding 2-2 is looped around in a slot 1-1 and 1 -10, and a volume end connects it to a commutator segment 3-2. Thus, the pan of the armature core slot 1 is looped around over a semicircle further once again, and the final volume end of an armature winding 2-1 is connected to a commutator segment 3-1, and the final volume end of an armature winding 2-2 is connected to a commutator segment 3-12, and it is cut. In drawing, P shows the hand of cut of an armature winding 2. Moreover, the illustration location of a carbon brush 4 corresponds, just before the armature winding 2 which constitutes an armature winding 2 completes rectification.

[0021] By thus, the 1 slot-1 segment method equipped with the commutator segment 3 of the armature core slot 1 and the same number By coiling a coil about over the perimeter (duplex as a result) of the armature core slot 1, one armature winding 2 to which the coil of the start of a volume was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively Since it becomes carrying out the coil of the two armature windings 2 to the semicircle of the armature core slot 1, and coiling an armature winding 2 around one-fold about, and the same thing, for example, an armature winding 2 by winding ******, since the cross section equivalent to ****** can be obtained to one-fold when the wire size of an armature winding 2 is phi0.65mm about an armature winding 2 at a duplex when the wire size of an armature winding 2 is phi0.45mm A thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained.

[0022] Moreover, if the wire size of an armature winding 2 is less than [phi0.45mm], since it is a thin line, it is stabilized and the conductor spacing in the hook 6 of a commutator can be secured. Since it becomes possible [poor fusing, deformation of an open circuit and hook 6, coil processing degradation, etc. to hook 6] for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction.

[0023] The gestalt 2 of implementation of invention, next the gestalt 2 of implementation of this invention are explained about drawing. Drawing 5 is drawing which looked at the field core and the armature core from the top. Drawing 6 is the graph of the life of the rate of a turn ratio, and a carbon brush. Drawing 7 is the side elevation of a commutator motor. The gestalt 2 of implementation of this invention is the modification of the gestalt 1 of implementation of invention. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. As for a field core and 14, 13 is [a field winding and 19] commutator motors. it is shown in drawing 5 and drawing 6 -- as -- an armature winding 2 -- all -- a conductor -- the spark depressor effect by transformer operation of an armature

winding 2 can be improved by setting up so that the ratio of a number and the number of field windings 14 may be set to more than 6:1, and spark generating becomes small. Thus, the number of turns of an armature winding 2 are made [many], and it becomes possible by decreasing the iron loss and copper loss of a field to make a life 1.2 times as long as before by the improvement in effectiveness, and rectification improvement.

[0024] an armature winding 2 -- all -- a conductor -- the ratio of a number and the number of field windings 14 -- more than 6: -- by setting up so that it may be set to 1 explains below why the improvement in effectiveness and a rectification improvement are achieved. Between the commutators which are a part of armatures which are body of revolution, the carbon brush performed current energization and has short-circuited it with the carbon brush in the generator or the motor. The operation which suppresses the short-circuit current which flows in case the current of an armature coil reverses the direction of current ejection 180 degrees electrically during a contact period is performed. For every rotation, this is a 2 times carbon brush, each coil of an armature short-circuits it, the current in a coil is because the direction is reversed from -1 to -1 next from +1 to -1 each time, the time amount starts the moment the armature coil short-circuited with the carbon brush, when a short circuit is canceled, it is finished, and it is a short time very much.

[0025] And if it becomes beyond the limit which there is delay of magnetic flux at the time of undercommutation, and is because it cannot finish negating the reactance voltage which changes with a current, and has the delay of magnetic flux, current change will become large at the time of termination of rectification, and it will become easy to generate a spark from the outlet of a brush. Moreover, at the time of an overcommutation, the progress condition of magnetic flux becomes quick undercommutation and reversely, and it lifting-comes to be easy of the same phenomenon. The condition of straight line commutation that a short-circuit current serves as current distribution proportional to the touch area of a carbon brush is opposite the most desirable. In order to make this condition, the inductance L of an armature winding and the relation between a commutating period T and the armature-winding resistance R The result of having checked R for it being satisfied with becoming L<RT and performing this straight line commutation in the experiment, By enlarging armature-winding resistance R when winding so that the ratio of all RT several/conductor ST coils may become six or more, as shown in drawing 6 , and setting up a line specification, a rectification improvement can be performed and the improvement in effectiveness and a life can be lengthened.

[0026] The gestalt 3 of implementation of invention, next the gestalt 3 of implementation of this invention are explained about drawing. The schematics in which drawing 8 shows coil arrangement of the armature winding of a commutator motor, and drawing 9 are the graphs of gap of a phase angle and the life of a carbon brush. The gestalt 3 of implementation of this invention is the modification of the gestalt 1 of implementation of invention. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. 16 is the field pole. As shown in drawing 8 , the phase angle X of the core of an armature winding 2 and the core of the field pole 16 is set up so that it may come among 10 degrees - 30 degrees. Thus, while there is little spark generating and it can control a black bar phenomenon by arranging according to the spark depressor effect by transformer operation with the next slot inner lining line of a hand of cut, improvement in the life of a brush can be aimed at. In addition, drawing 9 shows the life property of the carbon brush in the commutator motor 21 of input 1300W by rated voltage 100V.

[0027] Here, the include angle alpha which neutral shaft X-Y with a geometric phase angle X and electrical-neutral-axis X'-Y' make is said here, and, generally the hand of cut and hard flow of an armature are made forward. Usually, the shaft of a field and a carbon brush fixes adjustment of this include angle alpha, and it is carried out by changing the connection include angle of the armature coil lead to a commutator. This connection include angle is usually adjusted at the press fit include angle of the commutator to an armature core slot. When it asks for this optimal phase angle experimentally, as it is shown in drawing 9 , since it comes to the location where the sense of the magnetic flux produced according to the flowing current can expect spark depressor effect according to a transformer operation of an armature winding by setting it as 10-30 degrees, spark generating becomes small, a rectification improvement can be performed, and the improvement in effectiveness and a life can be lengthened. Therefore, it is effective in shifting and setting up the press fit include angle of a commutator from the core of a field and an armature core slot.

[0028] The gestalt 4 of implementation of invention, next the gestalt 4 of implementation of this invention are explained about drawing. The coil schematics of a commutator motor with which drawing 10 expresses the gestalt of implementation of this invention, and drawing 11 are the commutator connection section partial enlarged drawings of a commutator motor. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Next, the

coil gestalt of an armature coil is explained. As shown in drawing 10 and drawing 11 , the number of commutator segments 3 is the case (this is called "1 slot-2-N segment method") where the number of 24 and the armature core slots 1 is 12. With a winding machine with two coil flyers, the start of a volume starts a coil for the armature winding 2-1 which is in the position of symmetry, respectively, and 2-2 to coincidence. It is looped around in a slot 1-1 and 1-6, the start of a volume connects with a commutator segment 3-1, and the end of a volume connects an armature winding 2-1 to a commutator segment 3-2. And it is again looped around in a slot 1-1 and 1-6, and the end of a volume is connected to the commutator segment 3-3 of the next door of a commutator segment 3-2. By such coil approach, a coil is performed along the direction of a coil in good order, and an armature coil is formed.

[0029] Similarly, it is looped around in a slot 1-7 and 1 -12, the start of a volume connects with a commutator segment 3-13, and the end of a volume connects an armature winding 2-2 to a commutator segment 3-14. And it is again looped around in a slot 1-7 and 1 -12, and the end of a volume is connected to the commutator segment 3-15 of the next door of a commutator segment 3-14. Hereafter, it loops around over a semicircle with 12 slots of the armature core slot 1 similarly, and the volume end of each armature winding 2-1 does not cut to 3-13 after the volume end of an armature winding 2-2 connecting with 3-1, but an armature winding 2-1 is looped around in a slot 1-7 and 1 -12, and the end of a volume connects it to 3-14. An armature winding 2-2 is looped around in a slot 1-1 and 1-6, and the end of a volume connects it to a commutator segment 3-2.

[0030] Thus, the pan of the armature core slot 1 is looped around over a semicircle further once again, and the final volume end of an armature winding 2-1 is connected to a commutator segment 3-1, and the final volume end of an armature winding 2-2 is connected to a commutator segment 3-13, and it is cut. In drawing, P shows the hand of cut of armature Maki 2 line. Thus, since it becomes the same effectiveness as having carried out the coil of the armature winding 2 to juxtaposition by carrying out a double coil by one armature winding 2, for example, when the wire size of an armature winding 2 is phi0.45mm, the cross section equivalent to phi0.65mm can be obtained by winding ****** to a duplex.

[0031] By thus, the 1 slot-2-N segment method which equipped the commutator 5 with the twice as many commutator segment 3 as this to the number of the armature core slots 1 By coiling a coil about over the perimeter of the armature core slot 1, one armature winding 2 to which the coil only of the same number as the twice as many commutator segment 3 as this was carried out to the number of slots to a pair each of slots of the armature core 7 which has the start of a volume in the position of symmetry, respectively Since the number of slots becomes by 1/2 twice the number of commutator segments 3 and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core about one armature winding substantially, for example, an armature winding 2 by winding ******, since the cross section equivalent to ****** can be obtained to one-fold when the wire size of an armature winding 2 is phi0.65mm about an armature winding 2 at a duplex when the wire size of an armature winding 2 is phi0.45mm A thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained.

[0032] Moreover, if the wire size of an armature winding 2 is less than [phi0.45mm], since it is a thin line, it is stabilized and the conductor spacing in the hook 6 of a commutator can be secured. Since it becomes possible [poor fusing, deformation of an open circuit and hook 6, coil processing degradation, etc. to hook 6] for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction. In addition, with the gestalt 4 of implementation of this invention, although the number of commutator segments 3 described the case where the number of 24 and the armature core slots 1 was 12, in the case of the integral multiple of the number of the armature core slots 1, the number of commutator segments 3 will coil a coil about for one armature winding 2 to which the coil only of the same number as the commutator segment 3 of an integral multiple was carried out to the number of slots to a pair each of slots over the perimeter of the armature core slot 1.

[0033] The gestalt 5 of implementation of invention, next the gestalt 5 of implementation of this invention are explained about drawing. Drawing 12 is the coil schematics of the commutator motor showing the gestalt of implementation of this invention. Drawing 13 is the commutator connection section partial enlarged drawing of a commutator motor. Drawing 14 is the armature commutator section plan of a commutator motor. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. 17 is an armature winding for parallel winding. Next, the coil gestalt of an armature coil is explained. As shown in drawing 12 and drawing 13 , the number of commutator segments 3 is the case (1 slot-1 segment method) where the number of 22 and the armature core slots 1 is 22. With a

winding machine with two coil flyers, two armature windings 2-1 which have the start of a volume in the position of symmetry, respectively, 17-1 and two armature windings 2-2, and 17-2 are arranged in juxtaposition with one coil flyer, and a coil is started to coincidence.

[0034] The start of a volume connects with a commutator segment 3-1, and is looped around in a slot 1-1 and 1 -10, and the end of a volume connects an armature winding 2-1 and 17-1 to a commutator segment 3-2. Moreover, the start of a volume connects with a commutator segment 3-12, and is looped around in a slot 1-12 and 1 -21, and the end of a volume connects an armature winding 2-2 and 17-2 to a commutator segment 3-13. Hereafter, it loops around over the semicircle of the armature core slot 1 similarly, and each armature winding 2-1 and the volume end of 17-1 carry out a coil so that 3-12, each armature winding 2-2, and the volume end of 17-2 may be connected to 3-1.

[0035] By thus, the 1 slot-1 segment method equipped with the commutator segment 3 of the armature core slot 1 and the same number By carrying out the coil of the armature winding 2 made 2 juxtaposition to which the coil of the start of a volume was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle of the armature core slot 1 Since it becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the perimeter of the armature core slot 1 about one armature winding 2 substantially, for example, an armature winding 2, since the cross section equivalent to ****** can be obtained to one-fold when the wire size of an armature winding 2 is phi0.65mm by coiling an armature winding 2 around a duplex about when the wire size of an armature winding 2 is phi0.45mm A thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained.

[0036] Moreover, since it becomes possible if the wire size of an armature winding 2 is less than [phi0.45] for it to be stabilized and to be able to secure the conductor spacing in the hook 6 of a commutator, since it is a thin line, for poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. to hook 6 to be able to solve the trouble on quality, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction.

[0037] The gestalt 6 of implementation of invention, next the gestalt 6 of implementation of this invention are explained about drawing. Drawing 15 is the coil schematics of the commutator motor showing the gestalt of implementation of this invention. Drawing 16 is the commutator connection section partial enlarged drawing of a commutator motor. The same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Next, the coil gestalt of an armature coil is explained. As shown in drawing 15 R> 5 and drawing 16 , the number of commutator segments 3 is the case (1 slot-2-N segment method) where the number of 24 and the armature core slots 1 is 12. With a winding machine with two coil flyers, two armature windings 2-1 which have the start of a volume in the position of symmetry, respectively, 17-1 and two armature windings 2-2, and 17-2 are arranged in juxtaposition with one coil flyer, and a coil is started to coincidence.

[0038] It is looped around in a slot 1-1 and 1-6, the start of a volume connects with a commutator segment 3-1, and the end of a volume connects an armature winding 2-1 and 17-1 to a commutator segment 3-2. And it is again looped around in a slot 1-1 and 1-6, and the end of a volume is connected to the commutator segment 3-3 of the next door of a commutator segment 3-2. Thus, an armature winding 2-1 and 17-1 form an armature coil. Similarly, it is looped around in a slot 1-7 and 1 -12, the start of a volume connects with a commutator segment 3-13, and the end of a volume connects an armature winding 2-2 and 17-2 to a commutator segment 3-14. And it is again looped around in a slot 1-7 and 1 -12, and the end of a volume is connected to the commutator segment 3-15 of the next door of a commutator segment 3-14. Hereafter, it loops around over a semicircle with 12 slots of the armature core slot 1 similarly, and a coil is carried out so that each armature winding 2-1 and the volume end of 17-1 may be connected to 3-13 and the volume end of 2-2 and 17-2 may be connected to 3-1.

[0039] By thus, the 1 slot-2-N segment method which equipped the commutator 5 with the twice as many commutator segment 3 as this to the number of the armature core slots 1 By coiling a coil about over the perimeter of the slot 1 of an armature core, two armature windings 2 to which the coil only of the same number as the twice as many commutator segment 3 as this was carried out to the number of slots to a pair each of slots of the armature core 7 which has the start of a volume in the position of symmetry, respectively Since the number of slots becomes by 1/2 twice the number of commutator segments 3 and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the perimeter of the armature core slot 1 about one armature winding 2 substantially, for example, an armature winding 2, since the cross section equivalent to ****** can be obtained to

one-fold when the wire size of an armature winding 2 is phi0.65mm by coiling an armature winding 2 around a duplex about when the wire size of an armature winding 2 is phi0.45mm A thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained.
[0040] Moreover, if the wire size of an armature winding 2 is less than [phi0.45mm], since it is a thin line, it is stabilized and the conductor spacing in the hook 6 of a commutator can be secured. Since it becomes possible [poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. to hook 6] for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, the fault on manufacture is improvable. in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and also becomes a productivity drive by man day reduction. In addition, with the gestalt 6 of implementation of this invention, although the number of commutator segments 3 described the case where the number of 24 and the armature core slots 1 was 12, when the number of commutator segments 3 is the integral multiple of the number of the armature core slots 1, a coil will be coiled about for the armature winding of the number to which the coil only of the same number as the commutator segment 3 of an integral multiple was carried out to the number of slots to a pair each of slots over the perimeter of the slot 1 of an armature core.
[0041] The gestalt 7 of implementation of this invention is explained to the 7th gestalt of implementation of invention about drawing. The commutator connection section partial enlarged drawing of a commutator motor and drawing 19 of the coil schematics of a commutator motor with which drawing 1717 expresses the gestalt of implementation of this invention, and drawing 18 are the armature commutator section plans of a commutator motor. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Next, the coil gestalt of an armature coil is explained. As shown in drawing 19 from drawing 17 , the number of commutator segments 3 is the case (1 slot-1 segment method) where the number of 22 and the armature core slots 1 is 22.
[0042] With a winding machine with two coil flyers, the start of a volume starts a coil for the armature winding 2-1 which is in the position of symmetry, respectively, and 2-2 to coincidence. The start of a volume connects with a commutator segment 3-1, and is looped around in a slot 1-1 and 1 -10, and the end of a volume connects an armature winding 2-1 to a commutator segment 3-2. The start of a volume connects with a commutator segment 3-12, and is looped around in a slot 1-12 and 1 -21, and the end of a volume connects an armature winding 2-2 to a commutator segment 3-13. Hereafter, it loops around over the semicircle of the armature core slot 1 similarly, and the volume end of each armature winding 2-1 carries out end cutting after the volume end of 3-12 and 2-2 connecting with 3-1.
[0043] Next, a coil is started for an armature winding 2-1, 2-3 equivalent to 2-2, and 2-4 to coincidence like the 1st time from the place which counted from the cut place to the hand of cut, and shifted 2 segment location. The start of a volume connects with a commutator segment 3-3, and is looped around in a slot 1-3 and 1 -12, and the end of a volume connects an armature winding 2-3 to a commutator segment 3-4. The start of a volume connects with a commutator segment 3-14, and is looped around in a slot 1-14 and 1-1, and the end of a volume connects an armature winding 2-4 to a commutator segment 3-15. Hereafter, the pan of the armature core slot 1 is similarly looped around over a semicircle, the volume end of each armature winding 2-3 connects with 3-14, and the volume end of an armature winding 22-4 connects with 3-3.
[0044] By thus, the 1 slot-1 segment method equipped with the commutator segment 3 of the armature core slot 1 and the same number In case the start of a volume carries out the coil of the one armature winding 2 by which the coil was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle [every] perimeter of the armature core slot 1 mutually The volume start of the remaining semicircle start from the place predetermined ****** carried out, and and by carrying out a coil one by one from the location which was able to be shifted to the N/2nd opposite slots The same effectiveness as the method stated by claim 1 can be acquired, and the 1st time and the 2nd coil balance within one more slot become good, can reduce the initial imbalance of an armature 30%, and leads to an improvement of armature balance correction.
[0045] The gestalt 8 of implementation of invention, next the gestalt 8 of implementation of this invention are explained about drawing. Drawing 20 is the armature commutator section plan of the commutator motor showing the gestalt of implementation of this invention. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Although the volume start of the remaining semicircle used as the 2nd time was started with the gestalt 7 of implementation of invention from the place which shifted 2 segment location from it, the 2nd coil starting position is counted from the following commutator segment 3 with the gestalt 8 of implementation of this invention,

and it is ******** from the commutator segment 3 of 60 degrees - 120 degree beyond. Since how to wind is the same as the gestalt 7 of implementation of invention, concrete explanation is omitted. The same effectiveness as the method stated to the preceding clause by the coil approach of such an armature winding can be acquired, and in 90degree**alpha to a coil, for a ********** reason, the initial imbalance of an armature can be reduced about 30%, and the coil which is the 2nd time is led to an improvement of armature balance correction.

[0046] The gestalt 9 of implementation of invention, next the gestalt 9 of implementation of this invention are explained about drawing. It is the cutting enlarged drawing of the armature core slot section with which, as for the graph of the rate of a turn ratio, and a life with which drawing 21 expresses the gestalt of implementation of this invention, and drawing 22 , the graph of an input was considered as the number-of-turns specification, and, as for drawing 23 , the coil of the armature winding was carried out. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. The gestalt 9 of implementation of this invention is the 1 slot-1 segment method equipped with the commutator segment 3 of the armature core slot 1 and the same number like the gestalten 1 and 7 of implementation of invention. Carry out the coil of the one armature winding 2 to which the coil of the start of a volume was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle [every] perimeter of the armature core slot 1 mutually. (That is, one armature winding carries out a duplex volume to a pair each of slots) It is set as a case so that number of turns may become the 1st time > the 2nd time as the 1st time and the 2nd wirewound resistor become almost the same with the coil within an opposite slot, and the ratio may be set to 1.1-1.4.

[0047] Thus, since the same effectiveness as the method stated by claim 1 by setting up can be acquired, the coil configuration and wirewound resistor in the 1st [further] time and the 2nd time become uniform and rectification balance can improve, an improvement of a life is also expectable as shown in drawing 22 . Moreover, although 1-time the 1st time and the 2nd number of turns were able to express number of turns only with 1x8T, 1x9T, and an integral value by the specification of the same number as before By the ability of the width of 1x8.5T, 1x9.5T, and a coil specification to be extended by changing the 1st time and the 2nd number-of-turns specification as shown in drawing 23 , in case an input is adjusted by the coil specification, compared with the former, it becomes very advantageous.

[0048] The gestalt 10 of implementation of invention, next the gestalt 10 of implementation of this invention are explained. The coil schematics of a commutator motor with which drawing 2424 expresses the gestalt of implementation of this invention, and drawing 25 are the rectification meridian section partial enlarged drawings of a commutator motor. In drawing, the same configuration as the gestalt 1 of implementation of this invention omits explanation of a configuration of having attached the same sign and having overlapped. Next, the coil gestalt of an armature coil is explained. As shown in drawing 24 and drawing 25 , the number of commutator segments 3 is the case (1 slot-2-N segment method) where the number of 24 and the armature core slots 1 is 12.

[0049] With a winding machine with two coil flyers, the start of a volume starts a coil for the armature winding 2-1 which is in the position of symmetry, respectively, and 2-2 to coincidence. It is looped around in a slot 1-1 and 1-6, the start of a volume connects with a commutator segment 3-1, and the end of a volume connects an armature winding 2-1 to a commutator segment 3-2. And it is again looped around in a slot 1-1 and 1-6, and the end of a volume is connected to the commutator segment 3-3 of the next door of a commutator segment 3-2. By such coil approach, a coil is performed along the direction of a coil in good order, and an armature coil is formed. Similarly, it is looped around in a slot 1-7 and 1 -12, the start of a volume connects with a commutator segment 3-13, and the end of a volume connects an armature winding 2-2 to a commutator segment 3-14. And it is again looped around in a slot 1-7 and 1 -12, and the end of a volume is connected to the commutator segment 3-15 of the next door of a commutator segment 3-14. Hereafter, it loops around over a semicircle with 12 slots of the armature core slot 1 similarly, and the volume end of each armature winding 2-1 once cuts to 3-13 after the volume end of 2-2 connecting with 3-1.

[0050] Next, winding is started for an armature winding 2-1 and 2-2 to coincidence like the 1st time from the place which counted to the hand of cut and shifted 2 segment location from the cut place. An armature winding 2-1 is looped around in a slot 1-7 and 1 -12, and the end of a volume connects it to 3-14. An armature winding 2-2 is looped around in a slot 1-1 and 1-6, and the end of a volume connects it to a commutator segment 3-2. Thus, a pan with 12 slots of the armature core slot 1 is looped around over a semicircle further once again, and the final volume end of an armature winding 2-1 is connected to a commutator segment 3-1, and the final volume end of an armature winding 2-2 is connected to a commutator segment 3-13, and it is cut.

[0051] By thus, the 1 slot-2-N segment method which equipped the commutator 5 with the twice as many

commutator segment 3 as this to the number of the armature core slots 1 In case the start of a volume carries out the coil of the one armature winding 2 to which the coil only of the same number as the twice as many commutator segment 3 as this was carried out to the number of slots to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle [every] perimeter of the armature core slot 1 mutually The volume start of the remaining semicircle start from the place which shifted 2 segment location, and and by carrying out a coil one by one from the location which was able to be shifted to the N/2nd opposite slots The same effectiveness as the method stated by claim 1 can be acquired, and the 1st time and the 2nd coil balance within one more slot become good, can reduce the initial imbalance of an armature 30%, and leads to an improvement of armature balance correction.

[0052] The gestalt 11 of implementation of invention, next the gestalt 11 of implementation of this invention are explained about drawing. Although the volume start of the remaining semicircle used as the 2nd time was started with the gestalt 10 of implementation of invention from the place which shifted 2 segment location from it, the 2nd coil starting position is counted from the following commutator segment 3 with the gestalt 11 of implementation of this invention, and it is ******** from the commutator segment 3 of 60 degrees - 120 degree beyond. Since how to wind is the same as the gestalt 10 of implementation of invention, concrete explanation is omitted. The same effectiveness as the method stated to the preceding clause by the coil approach of such an armature winding can be acquired, and in 90degree**alpha to a coil, for a ********** reason, the initial imbalance of an armature can be reduced about 30%, and the coil which is the 2nd time is led to an improvement of armature balance correction. Furthermore, since a coil configuration and a wirewound resistor become uniform and can improve rectification balance, an improvement of a life is also expectable.

[0053] the gestalt 12 of implementation of invention -- the gestalt 12 of implementation of this invention Like the gestalten 4 and 10 of implementation of invention by the 1 slot-2-N segment method which equipped the commutator 5 with the twice as many commutator segment 3 as this to the number of the armature core slots 1 Carry out the coil of the one armature winding 2 to which the coil of the start of a volume was carried out to a pair each of slots of the armature core 7 which is in the position of symmetry, respectively over the semicircle [every] perimeter of the armature core slot 1 mutually. (That is, one armature winding carries out a duplex volume to a pair each of slots) It is set as a case so that number of turns may become the 1st time > the 2nd time as the 1st time and the 2nd wirewound resistor become almost the same with the coil within an opposite slot, and the ratio may be set to 1.1-1.4.

[0054] Thus, since the same effectiveness as the method stated by claim 1 by setting up can be acquired, the coil configuration and wirewound resistor in the 1st [further] time and the 2nd time become uniform and rectification balance can improve, an improvement of a life is also expectable as shown in drawing 22 . Moreover, although 1-time the 1st time and the 2nd number of turns were able to express number of turns only with 1x8T, 1x9T, and an integral value by the specification of the same number as before, it is being able to extend the width of 1x8.5T, 1x9.5T, and a coil specification by changing the 1st time and the 2nd number-of-turns specification, and in case an input is adjusted by the coil specification, compared with the former, it becomes very advantageous. Although all explained the commutator of alpha-hook method with the gestalt of implementation of invention mentioned above, it cannot be overemphasized that it is applicable about the commutator of a SUTAFINGU method (method which drives the connection of an armature winding into the slot in which it was prepared on the commutator, and is fixed).

[0055]

[Effect of the Invention] As mentioned above, it sets to the commutator motor of claim 1 of this invention. By the 1 slot-1 segment method equipped with the slot of an armature core, and the commutator segment of the same number By coiling a coil about over the slot perimeter (duplex as a result) of an armature core, one armature winding to which the coil of the start of a volume was carried out to a pair each of slots of the armature core which is in the position of symmetry, respectively Since the coil of the two armature windings is carried out to the slot semicircle of an armature core and it becomes the same thing as winding ****** about an armature winding one-fold, for example, an armature winding by winding ******, since the cross section equivalent to ****** can be obtained to one-fold when the wire size of an armature winding is phi0.65mm about an armature winding at a duplex when the wire size of an armature winding is phi0.45mm The effectiveness that a thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained is done so. Moreover, if the wire size of an armature winding is less than [phi0.45mm], since it is a thin line, it is stabilized and the conductor spacing of the commutator hook section can be secured. Since it becomes possible for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to

make a wound diameter small, poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. the fault on manufacture is improvable -- in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and the effectiveness of also becoming a productivity drive by man day reduction is done so.

[0056] the commutator motor of claim 2 of this invention -- setting -- an armature -- all -- a conductor -- since the spark depressor effect by transformer operation of an armature winding be improvable by setting up so that the ratio of a number and the number of field windings may be set to more than 6:1 , the number of turns of an armature winding be make [many] , it be decreasing the iron loss and the copper loss of a field , and the effectiveness it be ineffective to it being possible to make a life 1.2 times as long as before by the improvement in effectiveness and rectification improvement do so .

[0057] In the commutator motor of claim 3 of this invention, by setting up the phase angle of the core of an armature winding, and the core of the field pole so that it may come among 10 degrees - 30 degrees, while there is little spark generating and it can control a black bar phenomenon according to the spark depressor effect by transformer operation with the next armature core slot inner lining line of a hand of cut, the effectiveness that improvement in a brush life can be aim at is do so.

[0058] In the commutator motor of claim 4 of this invention By the 1 slot-2-N segment method which equipped the commutator with the commutator segment of a twice [more than] as many integral multiple as this to the number of the slots of an armature core By coiling a coil about over the slot perimeter (it being an integral multiple pile to the number of slots as a result) of an armature core, one armature winding to which the coil only of the same number as the commutator segment of an integral multiple was carried out to the number of slots to a pair each of slots of the armature core which has the start of a volume in the position of symmetry, respectively Since the number of slots serves as a 1-/integral multiple of the number of commutator segments and becomes the same as the coil gestalt of the 1 slot-1 segment method which coils a coil about over the slot perimeter of an armature core about one armature winding substantially, By the 1 slot-2-N segment method as well as the 1 slot-1 segment method stated by claim 1 for example, an armature winding by winding ******, since the cross section equivalent to ****** can be obtained to one-fold when the wire size of an armature winding is phi0.65mm about an armature winding at a duplex when the wire size of an armature winding is phi0.45mm The effectiveness that a thing equivalent to the effectiveness of the copper loss improvement which coils a thick wire and is obtained can be obtained is done so. Moreover, if the wire size of an armature winding is less than [phi0.45mm], since it is a thin line, it is stabilized and the conductor spacing of the commutator hook section can be secured. Since it becomes possible for the trouble on quality to be solvable, to be able to weaken rigidity of a coil since the coil of the thin line is carried out further, consequently to make a wound diameter small, poor fusing, deformation of an open circuit and a hook, coil processing degradation, etc. the fault on manufacture is improvable -- in addition -- and it becomes unnecessary to inspect the conductor spacing after connection visually, and the effectiveness of also becoming a productivity drive by man day reduction is done so.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] They are the coil schematics of the commutator motor showing the gestalt 1 of implementation of this invention.
[Drawing 2] It is the armature commutator section plan of the commutator motor showing the gestalt 1 of implementation of this invention.
[Drawing 3] It is a commutator connection side elevation showing the gestalt 1 of implementation of this invention.
[Drawing 4] It is a commutator connection section partial enlarged drawing showing the gestalt 1 of implementation of this invention.
[Drawing 5] It is drawing which looked at the field core showing the gestalt 2 of implementation of this invention, and the armature core from the top.
[Drawing 6] It is the graph of the life of the rate of a turn ratio and carbon brush showing the gestalt 2 of implementation of this invention.
[Drawing 7] It is the side elevation of the commutator motor showing the gestalt 2 of implementation of this invention.
[Drawing 8] They are the schematics showing coil arrangement of the armature winding showing the gestalt 3 of implementation of this invention.
[Drawing 9] It is the gap of a phase angle and the graph of the life of a brush showing the gestalt 3 of implementation of this invention.
[Drawing 10] They are the coil schematics of the commutator motor showing the gestalt 4 of implementation of this invention.
[Drawing 11] It is a commutator connection section partial enlarged drawing showing the gestalt 4 of implementation of this invention.
[Drawing 12] They are the coil schematics of the commutator motor showing the gestalt 5 of implementation of this invention.
[Drawing 13] It is a commutator connection section partial enlarged drawing showing the gestalt 5 of implementation of this invention.
[Drawing 14] It is an armature commutator section plan showing the gestalt 5 of implementation of this invention.
[Drawing 15] They are the coil schematics of the commutator motor showing the gestalt 6 of implementation of this invention.
[Drawing 16] It is a commutator connection section partial enlarged drawing showing the gestalt 6 of implementation of this invention.
[Drawing 17] They are the coil schematics of the commutator motor showing the gestalt 7 of implementation of this invention.
[Drawing 18] It is a commutator connection section partial enlarged drawing showing the gestalt 7 of implementation of this invention.
[Drawing 19] It is an armature commutator section plan showing the gestalt 7 of implementation of this invention.
[Drawing 20] It is an armature commutator section plan showing the gestalt 8 of implementation of this invention.
[Drawing 21] It is the graph showing the gestalt 9 of implementation of this invention of the rate of a turn ratio, and a life.
[Drawing 22] It is the graph of the number-of-turns specification showing the gestalt 9 of implementation of this invention, and an input.
[Drawing 23] The armature winding showing the gestalt 9 of implementation of this invention is the cutting enlarged drawing of the armature core slot section by which the coil was carried out.

[Drawing 24] They are the coil schematics of the commutator motor showing the gestalt 10 of implementation of this invention.
[Drawing 25] It is a commutator connection section partial enlarged drawing showing the gestalt 10 of implementation of this invention.
[Drawing 26] They are the coil schematics of the conventional commutator motor.
[Drawing 27] It is the armature side elevation of the conventional commutator motor.
[Drawing 28] It is the armature core slot cutting plane Fig. of the conventional commutator motor.
[Drawing 29] It is the commutator connection section partial enlarged drawing of the conventional commutator motor.
[Drawing 30] It is drawing which looked at a conventional field core and a conventional armature core from the top.

[Drawing 31] It is the armature commutator section plan of the conventional commutator motor.
[Drawing 32] It is the armature commutator section side elevation of the conventional commutator motor.
[Drawing 33] It is the armature commutator section bottom view of the conventional commutator motor.
[Drawing 34] It is the partial enlarged drawing of drawing 33 .
[Drawing 35] It is drawing of the coil injection section of a flyer winding machine which performs an armature winding.
[Description of Notations]
1 An armature core slot, 2 An armature winding, 3 A commutator segment, 5 A commutator, seven armature cores, 12 A revolving shaft, 13 A field core, 14 A field winding, 19 Commutator motor.

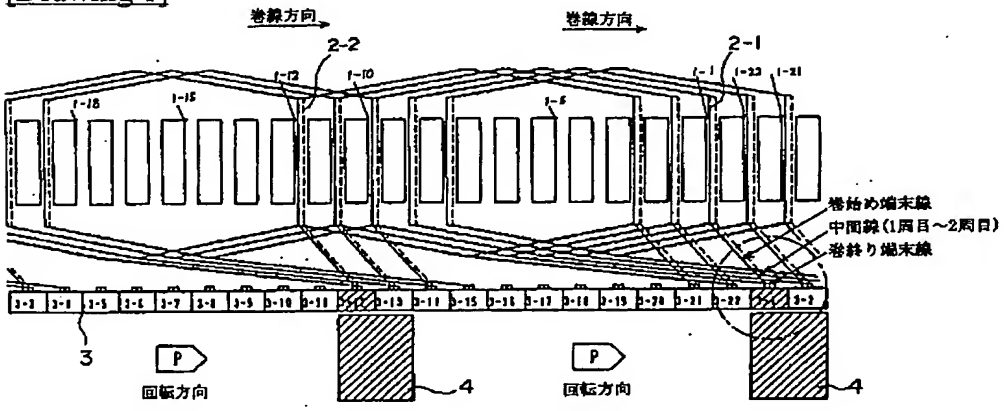
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

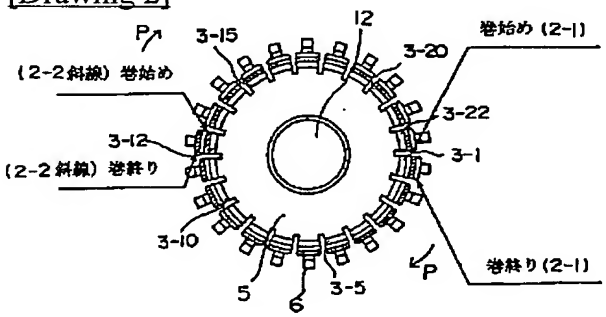
DRAWINGS

[Drawing 1]



1-1～1-22：電機子鉄心スロット
2-1～2-2：電機子巻線
3-1～3-22：整流子片
4：カーボンブラシ

[Drawing 2]



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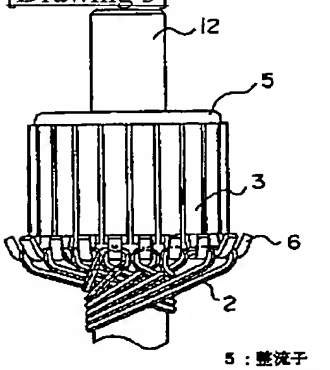
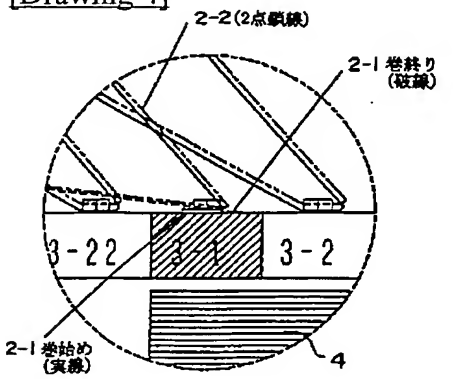


5：整流子
6：フック部
12：回転軸

[Drawing 4]



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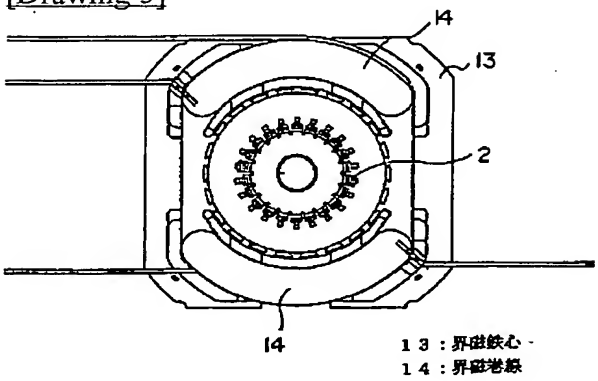

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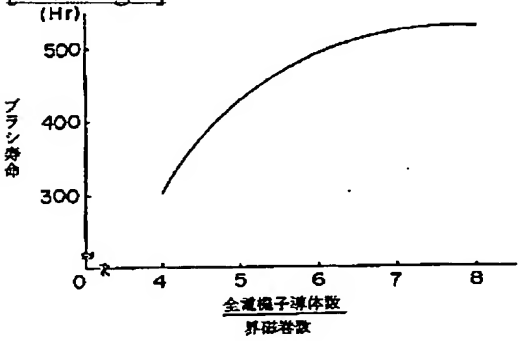

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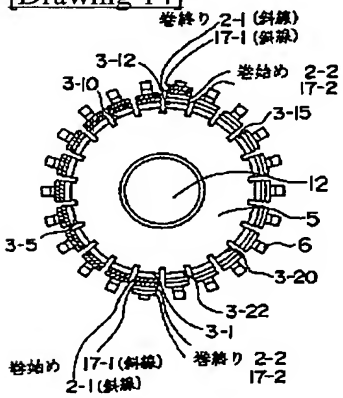

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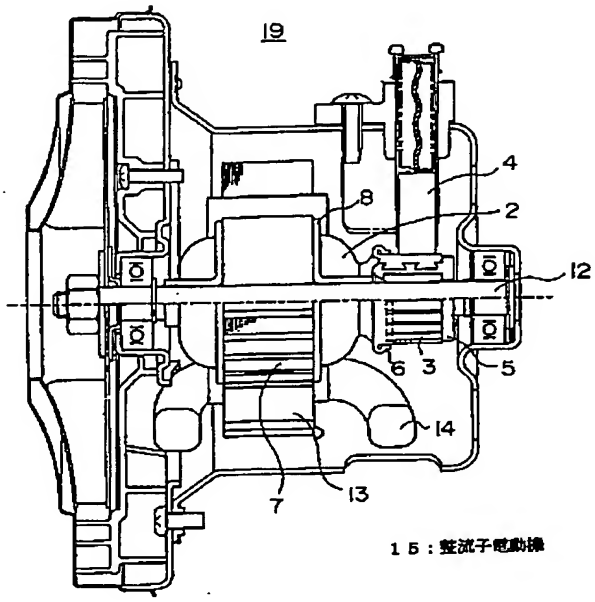

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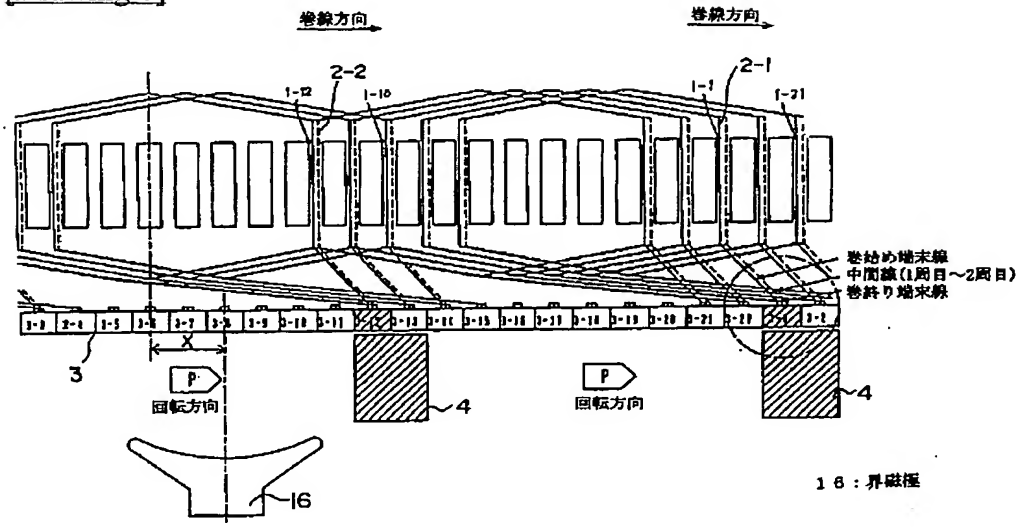

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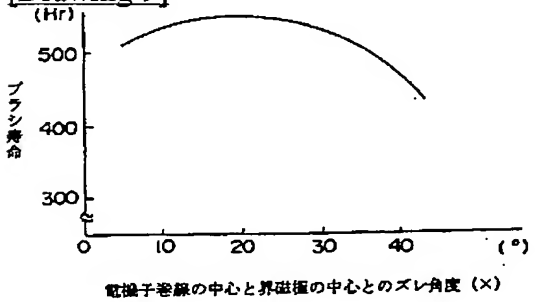

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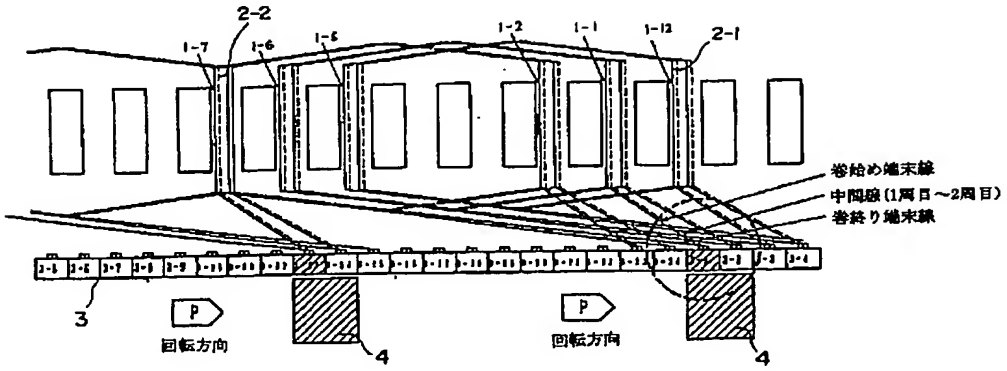

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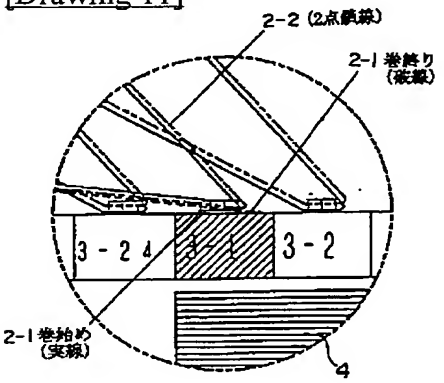

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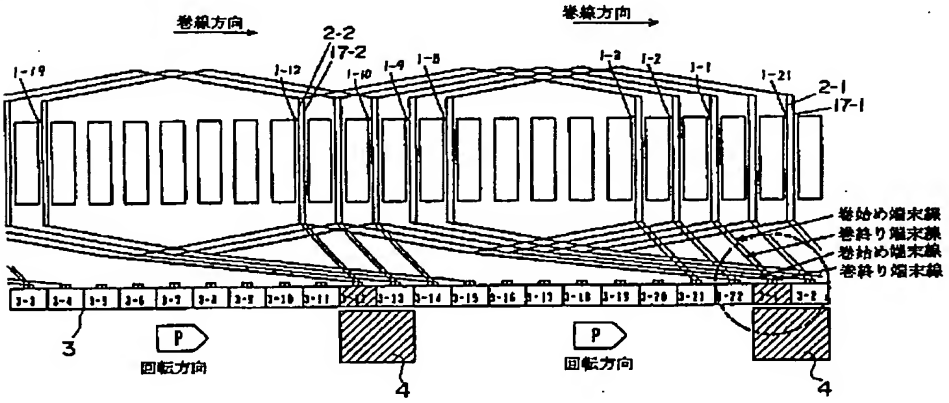
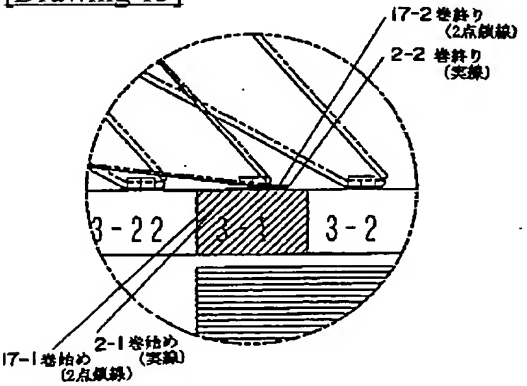


17-1～17-2：電機子巻線（並列用）

[Drawing 13]



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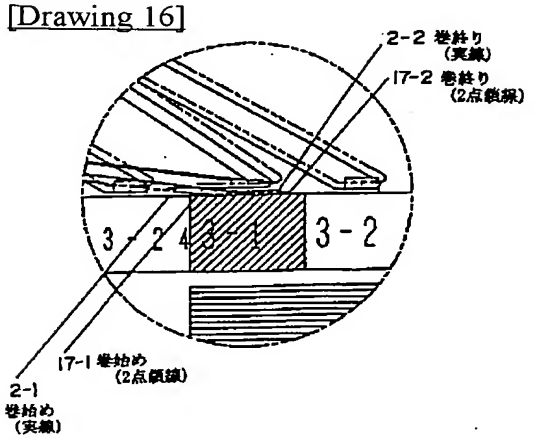

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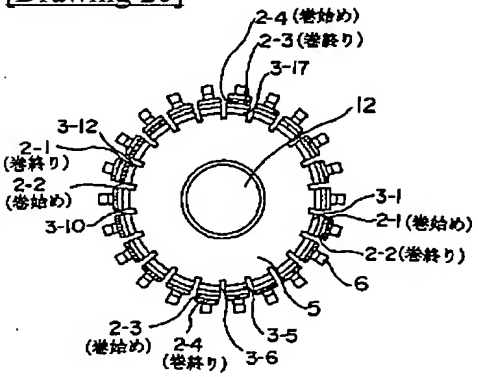

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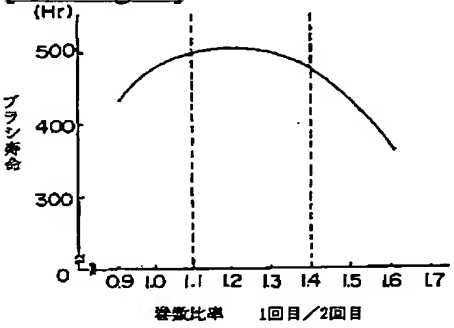

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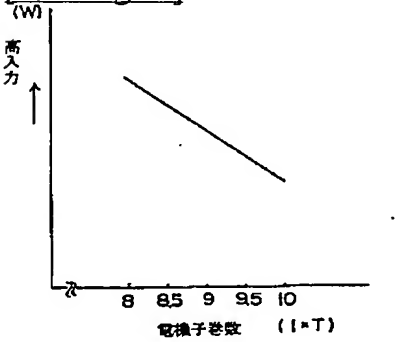

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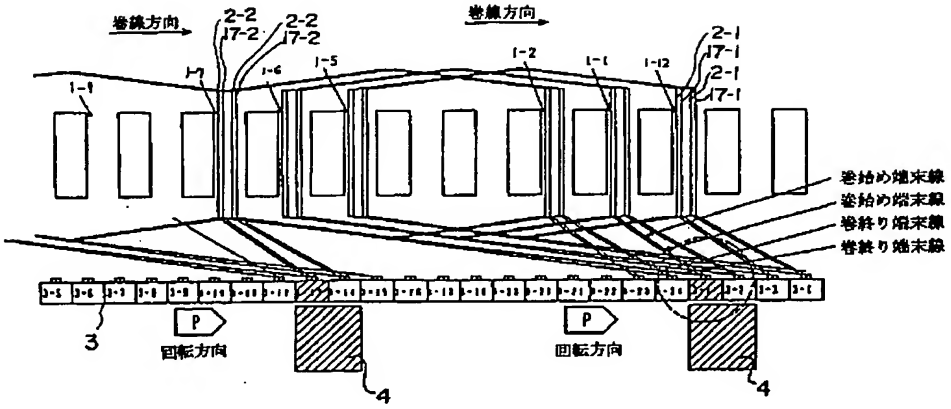

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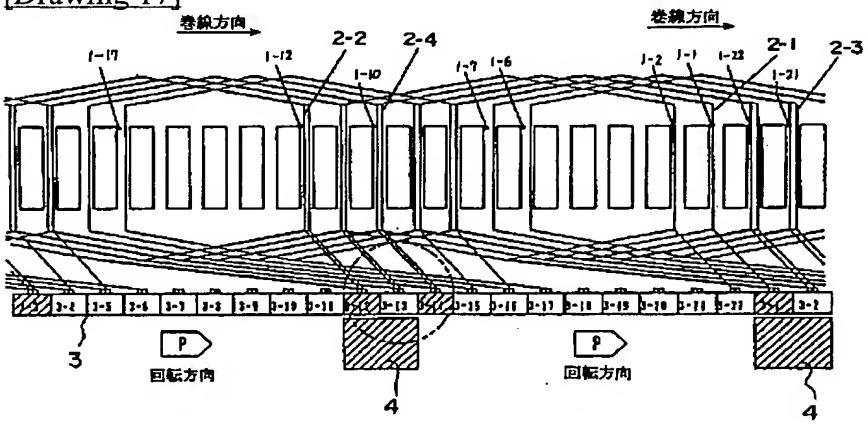

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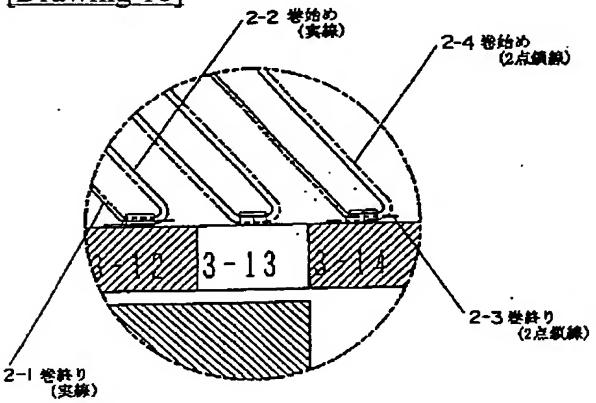

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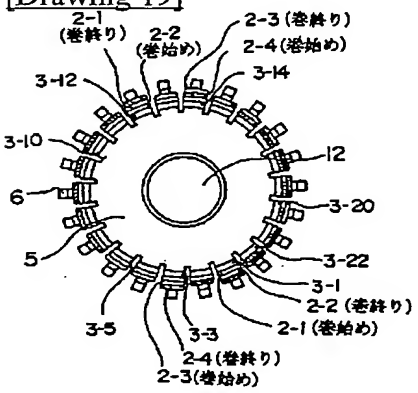

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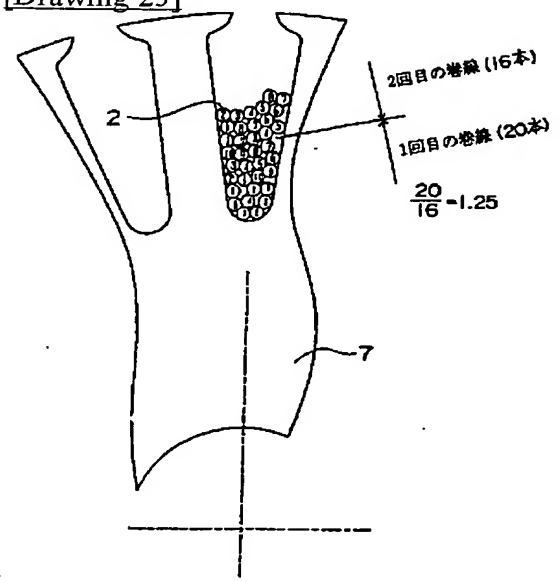

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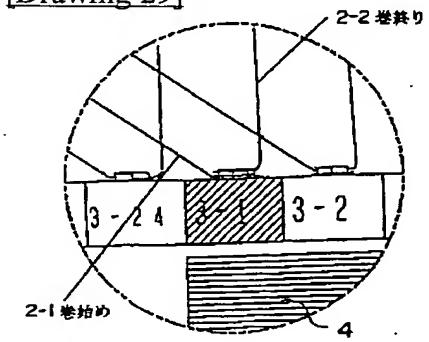

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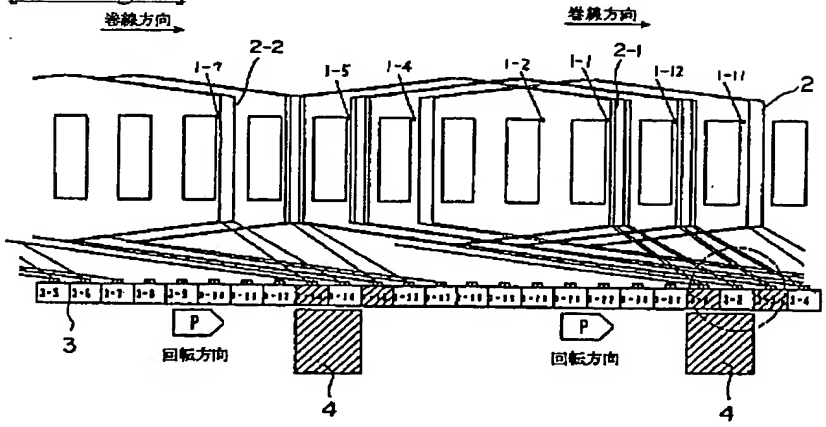

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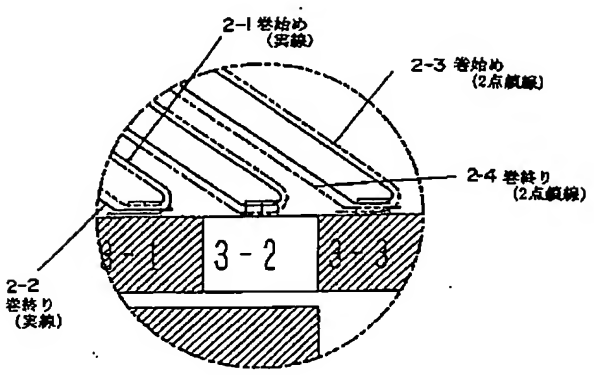

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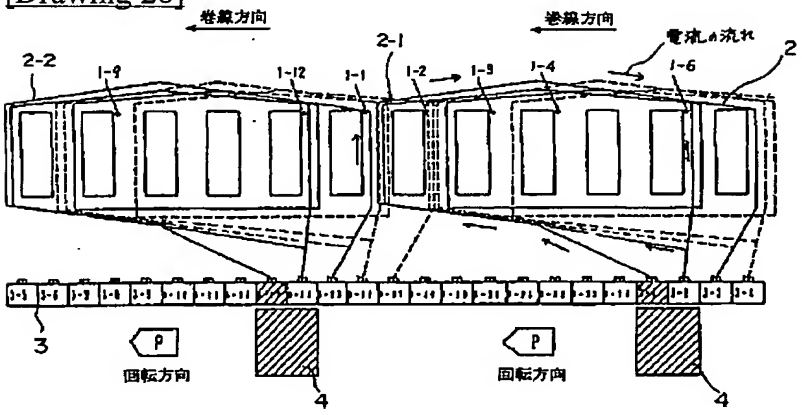

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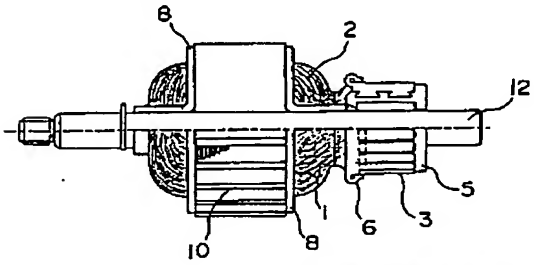
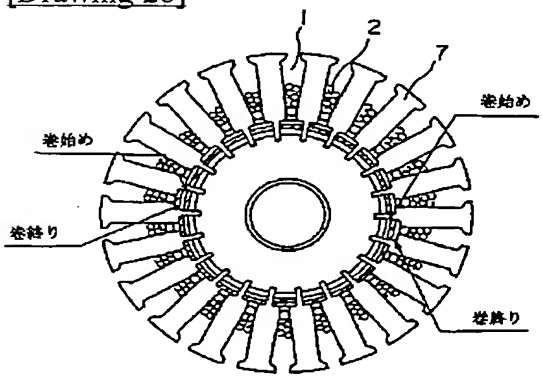


8：電機子鉄心端面絶縁部材
10：絶縁部材（ｳｪｯｼﾞ）

[Drawing 28]



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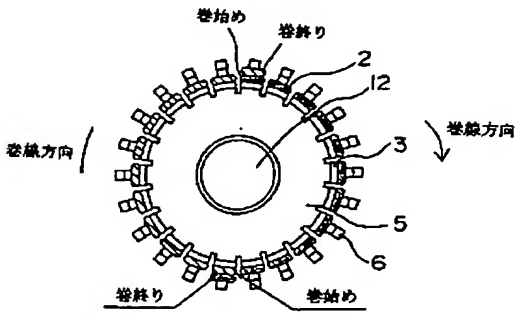

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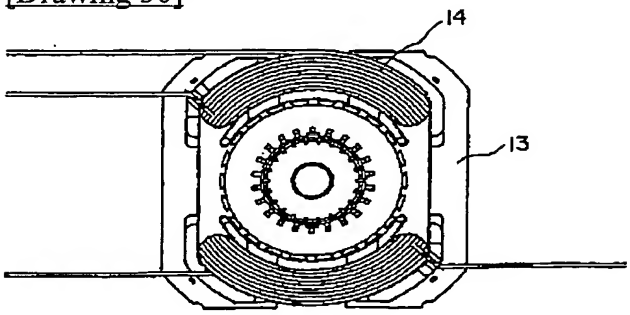

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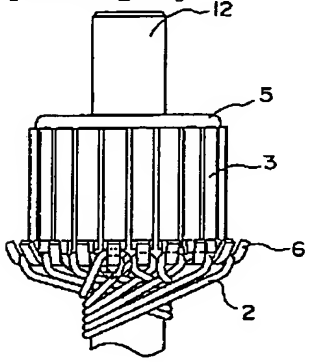

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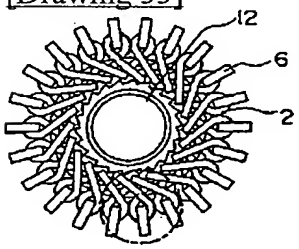

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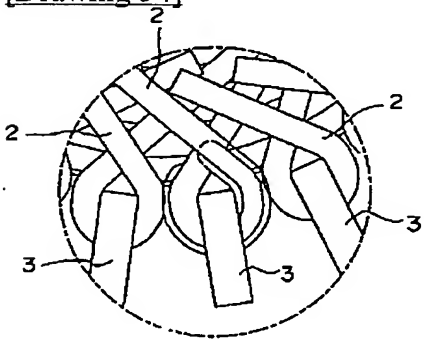

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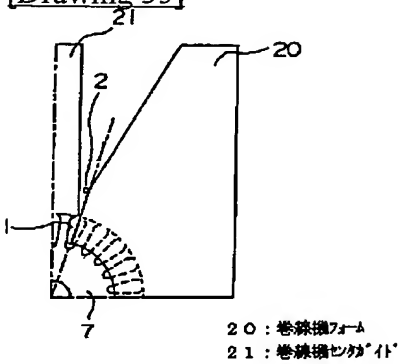

[Translation done.]

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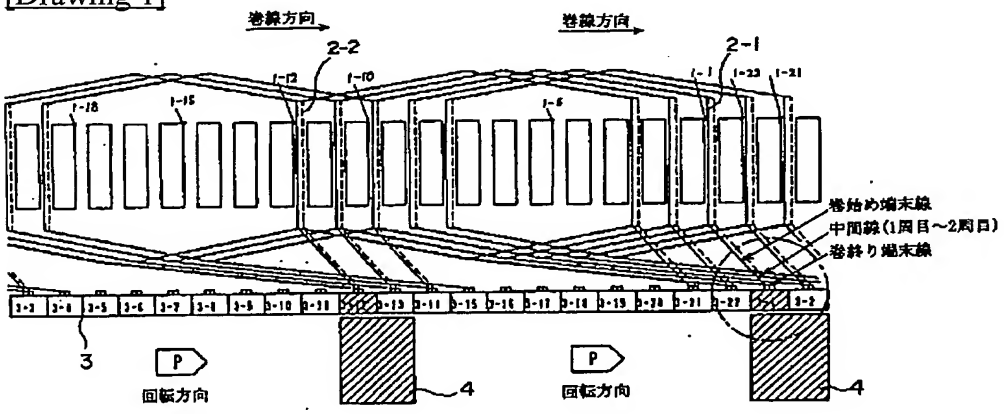
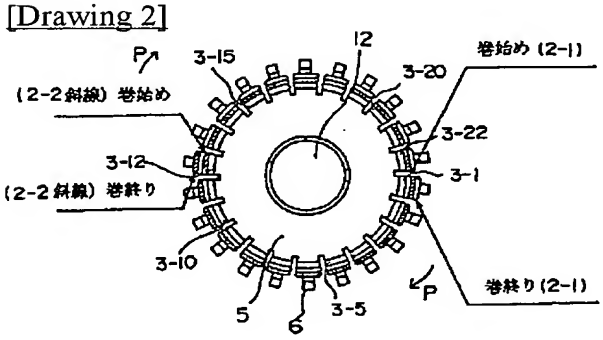
DRAWINGS

[Drawing 1]



1-1～1-22：電機子鉄心スロット
2-1～2-2：電機子巻線
3-1～3-22：整流子片
4：カーボンブラシ

[Drawing 2]



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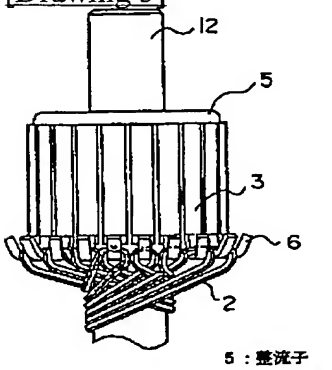
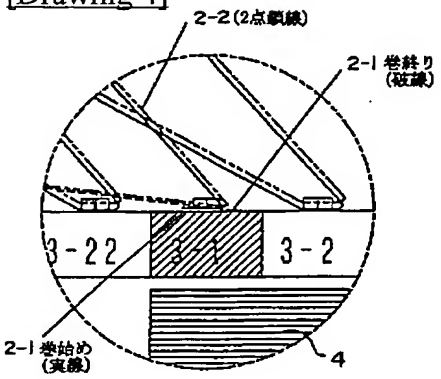


5：整流子
6：フック部
12：回転軸

[Drawing 4]



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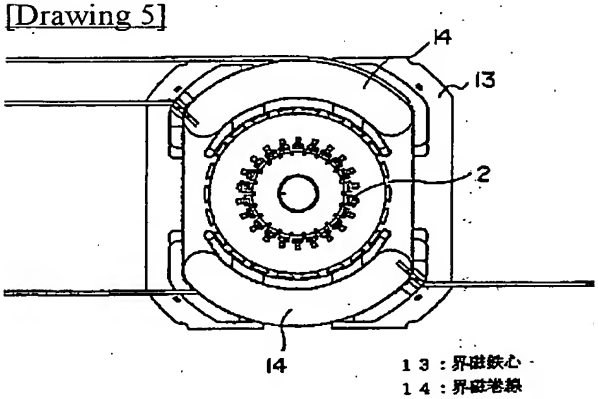

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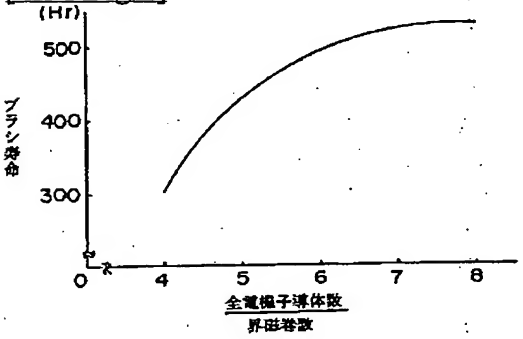

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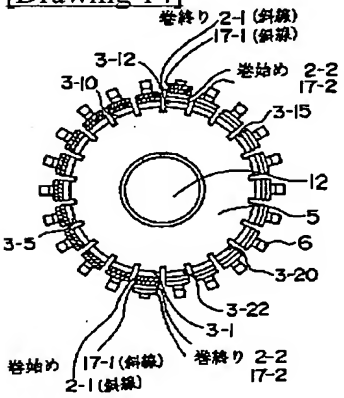

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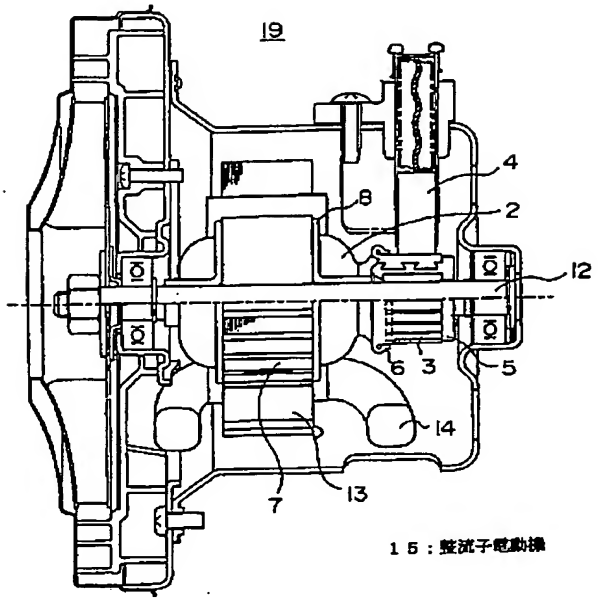

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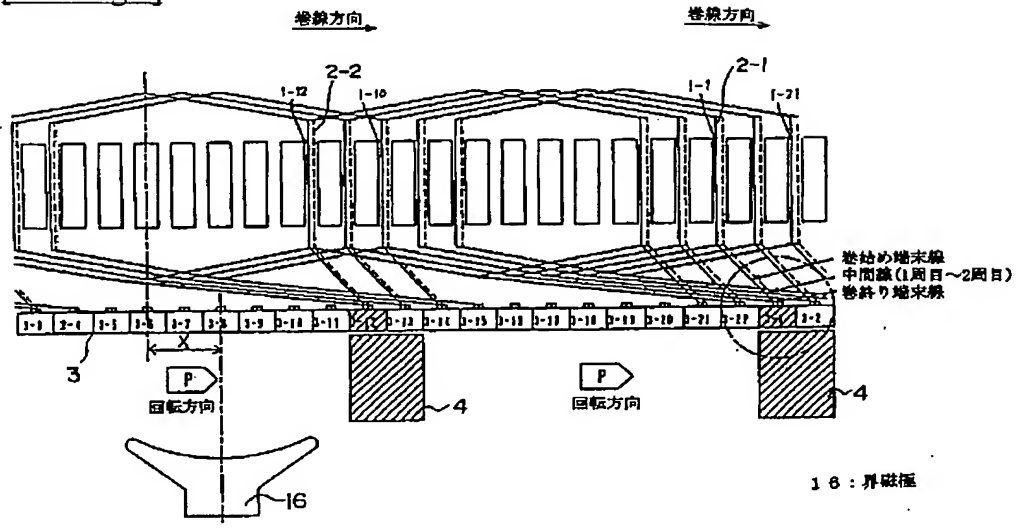

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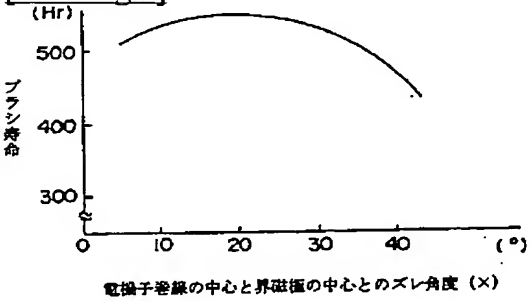

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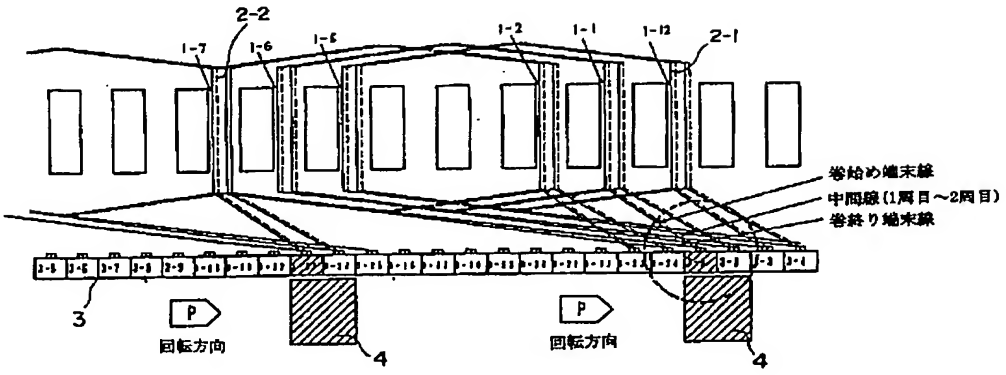

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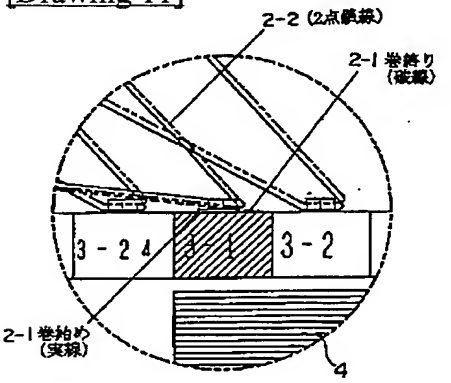

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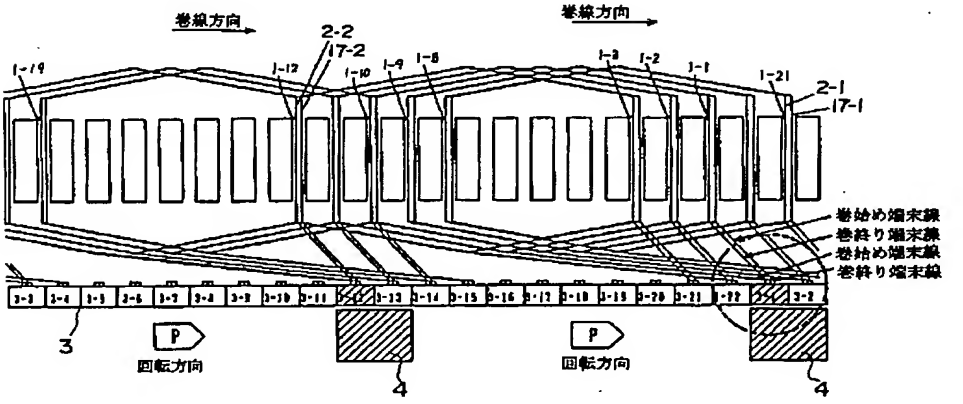
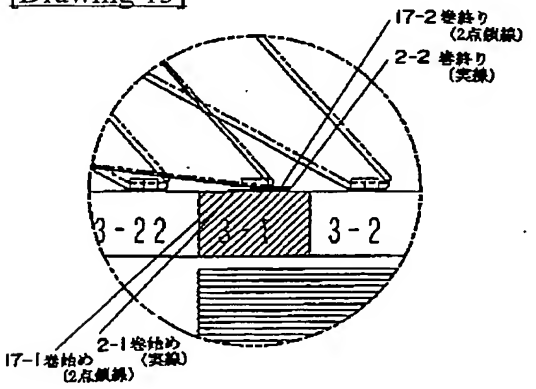


17-1～17-2：電機子巻線（並列用）

[Drawing 13]



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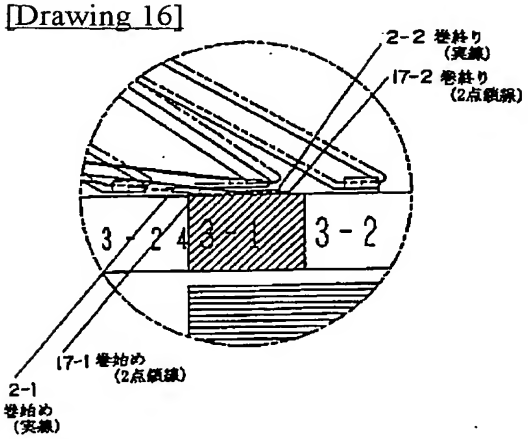

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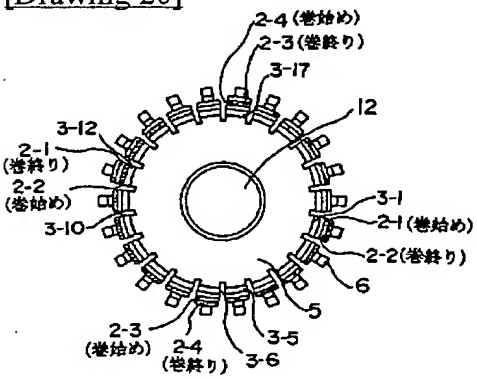

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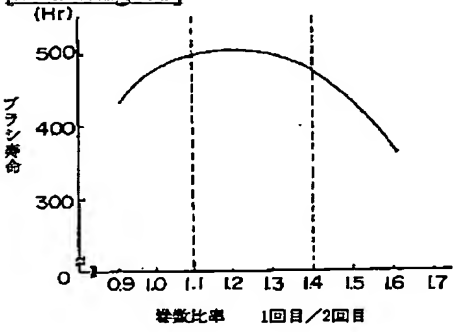

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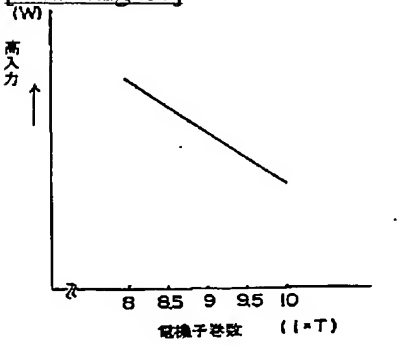

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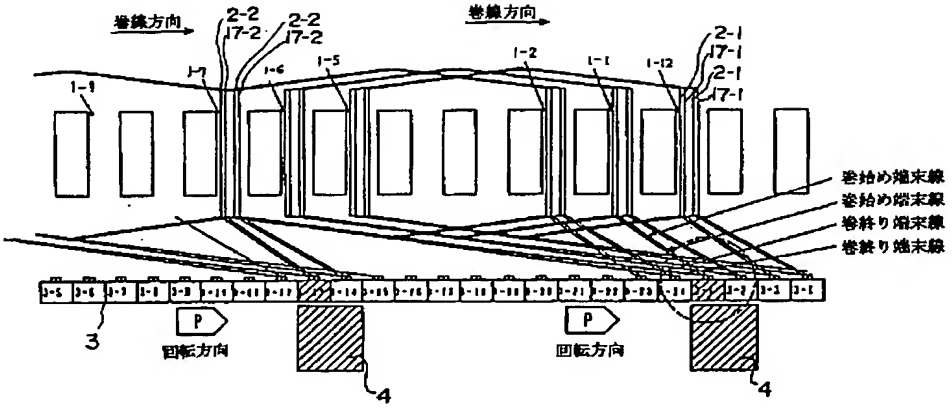

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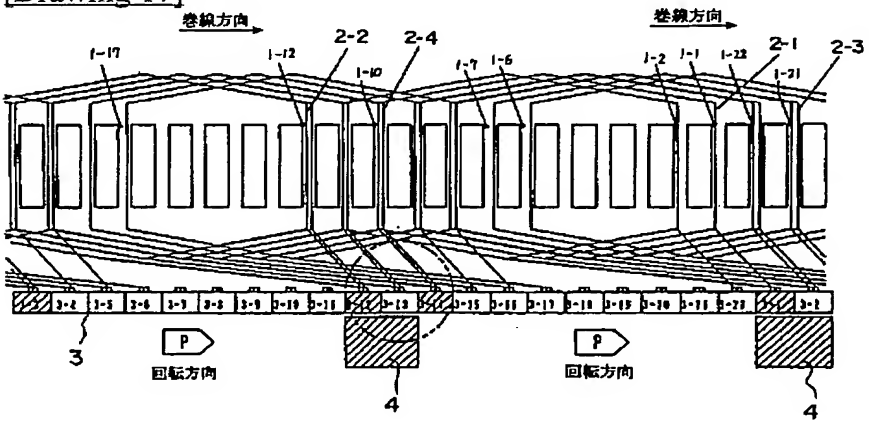
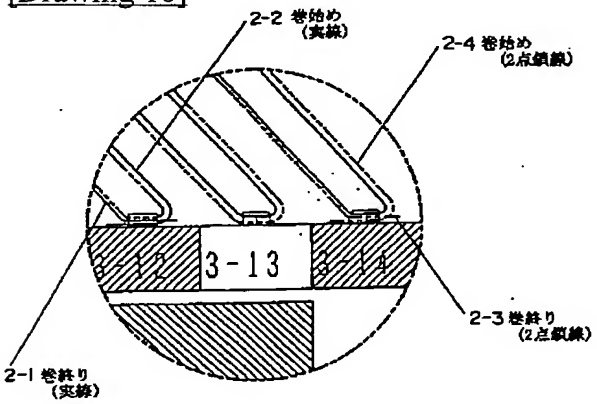


[Drawing 18]



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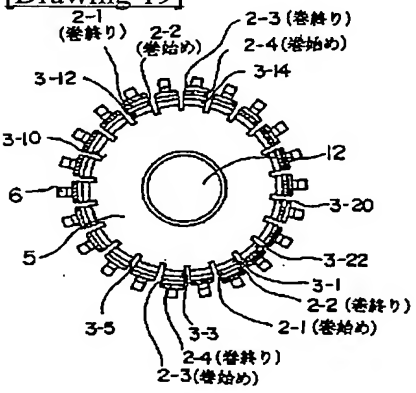

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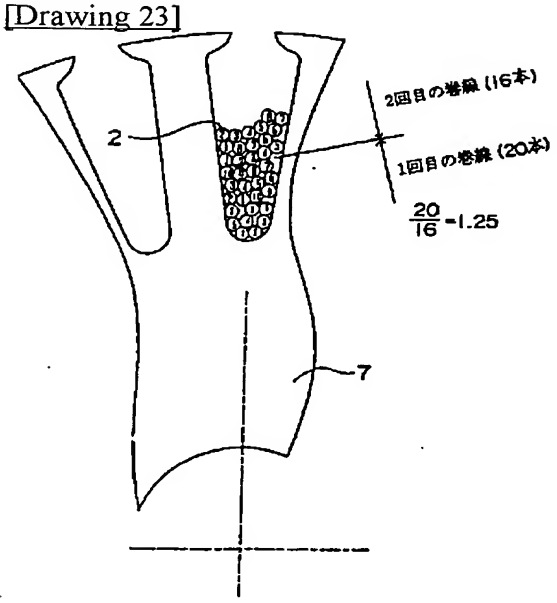

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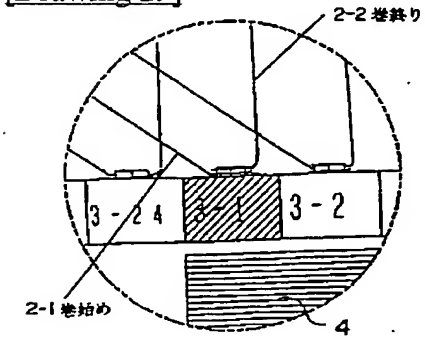

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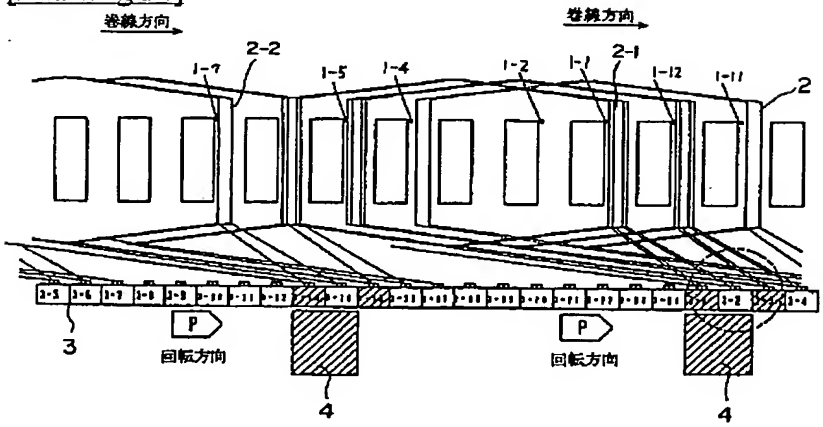

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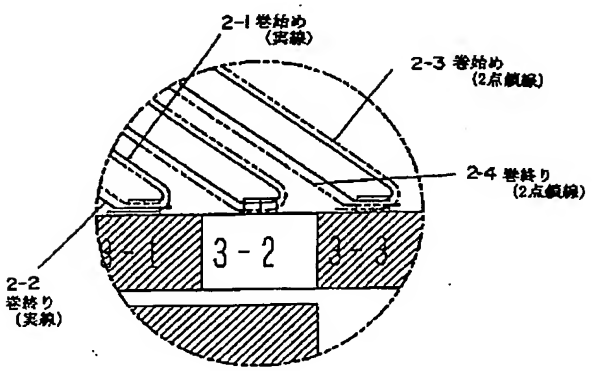

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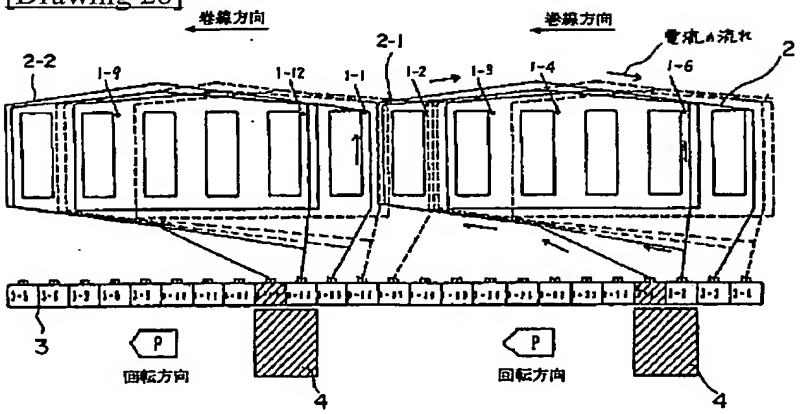

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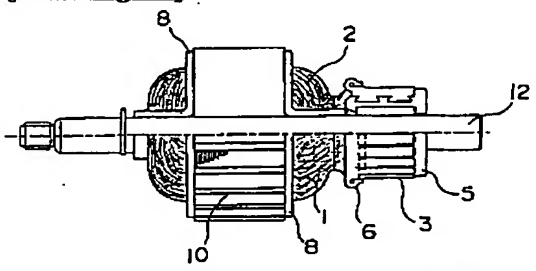
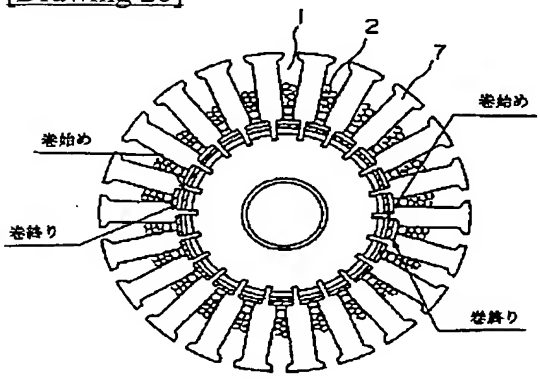


8：電機子鉄心端面絶縁部材
10：絶縁部材（ウェッジ）

[Drawing 28]



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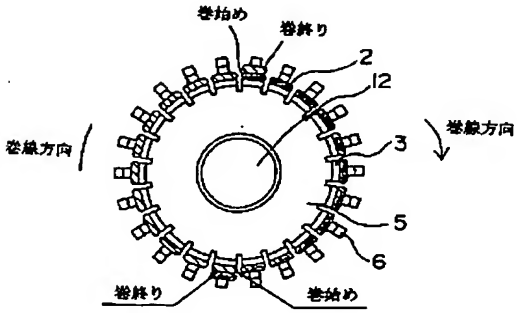

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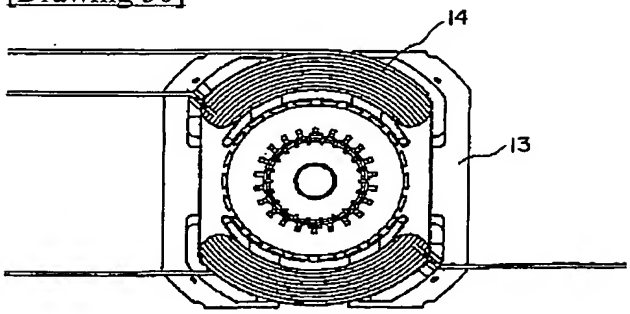
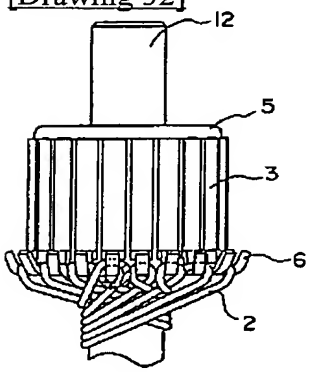


[Drawing 32]



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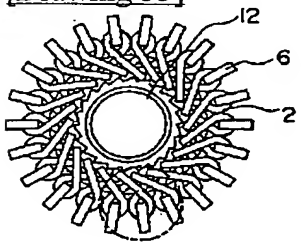

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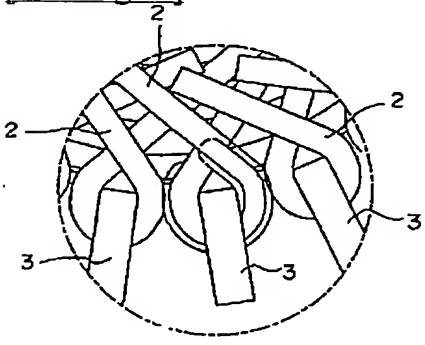

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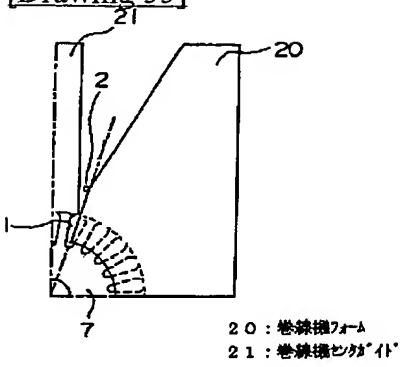

[Translation done.]

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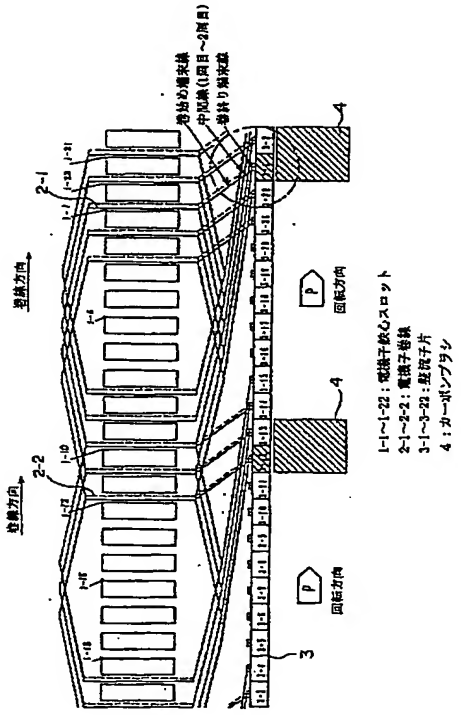
最終頁に続く

(54)【発明の名称】整流子電動機

(57)【要約】
【課題】　電機子巻線の線径を太くすることなく銅損低減による高効率化が可能となり、整流子フック部の線間距離を安定して確保でき、ヒュージング不良や断線、フックの変形や巻線加工劣化等の品質上の問題点を解決すること。
【解決手段】　回転軸１２と、回転軸１２に接続された２２個のスロット１を持つ電機子鉄心７と、回転軸１２に接続され、電機子鉄心７のスロット１と同数の整流子片３を有する整流子５と、巻始めがそれぞれ対称位置にある電機子鉄心７の各一対のスロットに対してそれぞれ少なくとも１回巻線された電機子巻線２を各々の隣りの整流子片３に連続的に順次接続して、２２／２個目の対スロット巻線後に、各々の電機子巻線２をそれから更に２２／２個目の対スロットまで順次巻線し、巻始めてから数えて２２＋１個目の整流子片３に電機子巻線２の端末がそれぞれ接続されるよう巻線して形成される電機子コイルとで構成されている。



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【特許請求の範囲】

【請求項１】　回転軸と、回転軸に接続された複数個Ｎのスロットを持つ電機子鉄心と、回転軸に接続され、電機子鉄心のスロットと同数の整流子片を有する整流子と、各対のスロット内に巻線された電機子巻線の終端を隣の対のスロット内に巻線された電機子巻線の始端と隣の整流子片に順次接続して形成された電機子コイルとで構成された整流子電動機において、

前記電機子コイルは、巻始めがそれぞれ対称位置にある各一対のスロットに対してそれぞれ少なくとも１回巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、Ｎ／２個目の対スロットまで順次巻線し、そのＮ／２個目の対スロット巻線後に、各々の電機子巻線をそれから更にＮ／２個目の対スロットまで順次巻線し、巻始めから数えてＮ＋１個目の整流子片に電機子巻線の端末がそれぞれ接続されるように巻線して形成されていることを特徴とする整流子電動機。

【請求項２】　上記整流子電動機において、電機子全導体数と界磁巻線数との比率が６以上となるよう設定したことを特徴とする請求項第１項記載の整流子電動機。

【請求項３】　上記整流子電動機において、前記電機子巻線の中心と界磁極の中心との位相角度を１０°～３０°の間になるよう設定したことを特徴とする請求項第１項記載の整流子電動機。

【請求項４】　回転軸と、回転軸に接続された複数Ｎ個のスロットを持つ電機子鉄心と、回転軸に接続され、電機子鉄心のスロットの数に対して２倍以上の整数倍の整流子片を有する整流子と、各対のスロット内にスロット数に対して整数倍の整流子片と同じ数だけ巻線された電機子巻線の終端を隣の対のスロット内に巻線された電機子巻線の始端と隣の整流子片に順次接続して形成された電機子コイルとで構成された整流子電動機において、

前記電機子コイルは、巻始めがそれぞれ対称位置にある各一対のスロットに対してそれぞれスロット数に対して整数倍の整流子片と同じ数だけ巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、Ｎ／２個目の対スロットまで順次巻線し、Ｎ／２個目の対スロットまで順次巻線し、そのＮ／２個目の対スロット巻線後に、各々の電機子巻線をそれから更にＮ／２個目の対スロットまで順次巻線し、巻始めから数えてＮ＋１個目の整流子片に電機子巻線の端末がそれぞれ接続されるように巻線して形成されていることを特徴とする整流子電動機。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、電気掃除機及び電動工具等の回転機器に使用される整流子電動機に関するものである。

【０００２】

【従来の技術】近年の整流子電動機は、小型・高出力化

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の傾向を示し、それに使用される電機子に求められる性能課題もコア形状、コアグレード、板厚改善による鉄損低減や電機子巻線改善による銅損低減が求められており、特に電気掃除機に使用される整流子電動機は高効率を求めるための電機子巻線の太線化が進められている。

【０００３】図２６は例えば、特公平６－３８７０４号公報に示された従来の整流子電動機の巻線結線図、図２７は従来の整流子電動機の電機子側面図、図２８は従来の整流子電動機の電機子鉄心スロットの部分切断面の拡大図、図２９は従来の整流子電動機の整流子結線部部分拡大図、図３０は従来の界磁鉄心と電機子鉄心を上から見た図、図３１は従来の整流子電動機の電機子整流子部上面図、図３２は従来の整流子電動機の電機子整流子部側面図、図３３は従来の整流子電動機の電機子整流子部下面図、図３４は図３３の部分拡大図、図３５は電機子巻線を行うフライヤー巻線機の巻線投入部の図である。

【０００４】図において、１は電機子鉄心スロットで１－１…１－１２はスロット番号を表す。前記電機子鉄心スロット１の中には電機子巻線２が巻装される。３は整流子片、３－１…３－２４は整流子片番号を表す。４はカーボンブラシ、５は整流子、６は整流子巻線結線部（以下、「フック」という）、７は電機子鉄心、８は電機子鉄心端面絶縁部材、９は電機子鉄心スロット絶縁部材、１０は遠心力で電機子巻線が電機子鉄心スロットから飛び出さないよう保持する絶縁部材（以下、「ウェッジ」という）、１１は電機子巻線を絶縁固着するワニス等の有機液剤、１２は回転軸、１３は界磁鉄心、１４は界磁巻線、２０は巻線機のフォーム、２１は巻線機のセンターガイドである。

【０００５】次に、従来例の動作について説明する。図では整流子５はαフックタイプで、整流子片３の数が２４、電機子鉄心スロット１の数が１２の場合について示す。回転軸１２に接続された１２個のスロットを持つ電機子鉄心スロット１の両端面とこの両端面と繋がる回転軸部１２には例えば、ＰＥＴ、ＰＢＴ等の樹脂及び紙等でできた電機子鉄心端面絶縁部材８を配置している。また、電機子鉄心スロット１の内部には例えば、ポリエステルフィルム及び紙等でできた電機子鉄心スロット絶縁部材９を配置している。整流子５は電機子鉄心スロット１と２倍の整流子片３を備えている。

【０００６】通常、巻線機の２つの巻線フライヤーにて、電機子巻線２－１と２－２を同時に電機子鉄心スロット１－１及び１－６内と１－７及び１－１２内に収納されながら複数回重ねて巻線された電機子巻線２は、巻線後に終端を整流子５のフック６にα状に巻付け（α－フック方式）ながら結線され、２本の電機子巻線２はそれぞれ次の電機子鉄心スロット１に順次２つの巻線フライヤーで連続的に巻線されて、全周に渡り巻装した１２個の電機子巻線２が電機子コイルを構成し、それぞれ巻始めから数えて１３個目の整流子片３に電機子巻線２の

端末が接続されるよう電機子を構成する。電機子結線終了後、フック６を加圧しながらヒュージングにて電機子巻線２と前記フック６を熱溶着接続させる。

【０００７】しかしながら、線径φ０．５以上の電機子巻線２をα状に巻線した場合、図３４に示すように、線径が太いため電機子巻線２の剛性が強くフック６の両側では電機子巻線２の屈曲部のＲが大きく張り出してしまうため、隣あったフック６との線間距離を確保できず、絶縁不良が起こりやすい。また、太線をヒュージングする際、細線に比べて熱溶着するためには、大電流が流れ加圧力も強くなるのでヒュージング不良や断線不良を起こしやすい。さらに、線径が太くなると電機子巻線２の剛性が強いため、巻線時にフック６が変形してしまうという問題も発生する。

【０００８】また、図のように線径が太いと電機子巻線２の剛性が強く、巻線テンションも十分にかからないため巻線を最小径で巻くことができない。電機子鉄心スロット１内での太線化による占積率の拡大でウェッジ１０の挿入スペースがなくなる恐れもある。さらに、整流子５と電機子鉄心スロット１間の巻線部が大きくなることから電機子巻線２を絶縁固着するワニス１１を流下するとこのワニス１１が整流子５表面に流れ込み整流不良を起こす恐れが生ずる。また、フック６における太線接続後の線間距離を目視確認する必要があり工数増加による生産性低下にもつながる恐れがある。

【０００９】また、図３５のように巻線機の所定の位置にフライヤー（図示せず）を固定した主軸の一端に取り付けたフォーム２０を設け、このフォーム３０とセンタガイド２１に沿って電機子巻線２を巻回して電機子鉄心７の外周面に形成された電機子鉄心スロット１に挿入するようにしたもので、電機子巻線２はフォーム２０に沿ってセンターより１５°±１０°傾いた角度より電機子鉄心スロット１へ案内される。これらのフォーム２０は、電機子鉄心７を挟持するチャック（図示せず）に固定され、最後のスロットまで電機子巻線２が巻けるように途中、電機子がインデックスする時、フォーム２０がコイルエンドに干渉しないように逃げを設けている。そのため、フォーム２０は電機子巻線２を電機子鉄心スロット１の入口までしか案内できず、フォーム２０の先端から飛んだ電機子巻線２は弛んで電機子鉄心スロット１の中で自由な状態になる。電機子鉄心スロット１の開口巾βは、巻線投入角度により実際はβ／２に近い値となるため、フライヤーより繰り出される電機子巻線２の線径がφ０．５ｍｍ以上の場合、電機子巻線２が電機子鉄心スロット１の開口部に接触して加工劣化を起こす恐れがある。

【００１０】

【発明が解決しようとする課題】従来の整流子電動機の電機子巻線の巻線方法は以上のように構成されているので、電機子巻線２の線径がφ０．４５ｍｍ以下の比較的

細い線径のものには問題がないが、電機子巻線２の線径がφ０．５ｍｍ以上の巻線については、電機子巻線２のフック６での線間距離は安定して確保することが難しくなり、フック６に対するヒュージング不良や断線、フック６の変形、また電機子巻線２が電機子鉄心スロット１の開口部に接触して加工劣化を起こす恐れがあるなど、品質上の問題点が多くなる。更にまた、太線化により巻径が大きくなることによる弊害も起こり、なお且つ、電機子巻線接続後の線間距離を目視確認する必要があり工数増加による生産性低下にもつながる。

【００１１】この発明は上記のような問題点を解決するためになされたもので、電機子巻線の線径を太くすることなく銅損低減による高効率化が可能となり、また１回目と２回目の巻回数を変えることができるために入力の微調整が行え、さらに整流子のフックにおける線間距離を安定して確保でき、ヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決するような整流子電動機を提供することを目的としている。

【００１２】

【課題を解決するための手段】この発明の請求項１の整流子電動機の電機子巻線の巻線方法について、電機子鉄心のスロットと同数の整流子片を備えた１スロット－１セグメント方式では、電機子コイルは、巻始めがそれぞれ対称位置にある各一対のスロットに対してそれぞれ少なくとも１回巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、Ｎ／２個目の対スロットまで順次巻線し、そのＮ／２個目の対スロット巻線後に、各々の電機子巻線をそれから更にＮ／２個目の対スロットまで順次巻線し、巻始めから数えてＮ＋１個目の整流子片に電機子巻線の端末がそれぞれ接続されるように巻線して形成されている。

【００１３】このように、電機子鉄心のスロットと同数の整流子片を備えた１スロット－１セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一対のスロットに対して巻線された１本の電機子巻線を電機子鉄心のスロット全周（結果として２重）にわたって巻線を巻き回すことにより、２本の電機子巻線を電機子鉄心のスロット半周に巻線し、電機子巻線を１重に巻回すことと同じこととなるため、例えば、電機子巻線の線径がφ０．４５ｍｍの場合、電機子巻線を２重に巻回すことにより、電機子巻線の線径がφ０．６５ｍｍの場合に電機子巻線を１重に巻き回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。また、電機子巻線の線径がφ０．４５ｍｍ以下であれば、細線であるため整流子フック部の線間距離を安定して確保することができ、ヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善で

きる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。

【００１４】この発明の請求項２の整流子電動機について、電機子全導体数と界磁巻線数との比率が６以上：１となるよう設定する。このような巻線数の比率にすることで電機子巻線の変圧器作用による火花抑制効果を改善できる。このように、電機子巻線の巻数を多くし、界磁の鉄損及び銅損を減少させることで、効率向上と整流改善により寿命を従来より１．２倍長くすることが可能となる。

【００１５】この発明の請求項３の整流子電動機について、電機子巻線の中心と界磁極の中心との位相角度を１０°～３０°の間になるよう設定する。このように配置することで、回転方向の次の電機子鉄心スロット内巻線との変圧器作用による火花抑制効果により火花発生が少なく、ブラックバー現象を抑制することができるとともにブラシの寿命の向上を図ることができる。

【００１６】この発明の請求項４の整流子電動機の電機子巻線について、電機子鉄心のスロットの数に対して整流子に２倍以上の整数倍の整流子片を備えた１スロット－２Ｎセグメント方式では、電機子コイルは、巻始めがそれぞれ対称位置にある各一対のスロットに対してそれぞれスロット数に対して整数倍の整流子片と同じ数だけ巻線された電機子巻線を各々隣りの整流子片に連続的に順次接続して、Ｎ／２個目の対スロットまで順次巻線し、Ｎ／２個目の対スロットまで順次巻線し、そのＮ／２個目の対スロット巻線後に、各々の電機子巻線をそれから更にＮ／２個目の対スロットまで順次巻線し、巻始めから数えてＮ＋１個目の整流子片に電機子巻線の端末がそれぞれ接続されるように巻線して形成されている。

【００１７】このように、電機子鉄心のスロットの数に対して整流子に２倍以上の整数倍の整流子片を備えた１スロット－２Ｎセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一対のスロットに対してスロット数に対して整数倍の整流子片と同じ数だけ巻線された１本の電機子巻線を電機子鉄心のスロット全周（結果としてスロット数に対して整数倍重）にわたって巻線を巻き回すことにより、スロット数は整流子片の数の１／整数倍となって実質的に１本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す１スロット－１セグメント方式の巻線形態と同じになるため、請求項１で述べた１スロット－１セグメント方式と同じように性能改善効果と生産性向上による効果を得ることができる。

【００１８】

【発明の実施の形態】発明の実施の形態１

以下、この発明の実施の形態１を図について説明する。図１はこの発明の実施の形態１を表す整流子電動機の巻線結線図、図２は整流子電動機の電機子整流子部上面図、図３は整流子結線側面図、図４は整流子電動機の整流子結線部部分拡大図である。図において、１は電機子鉄心スロット、１－１…１－２２はスロット番号を表す。２は電機子巻線、前記電機子鉄心スロット１の中には順次電機子巻線が装着され、図１には電機子巻線２－１、２－２を例示した。３は整流子片、３－１…３－２２は整流子片の番号を表す。４はカーボン刷子、５は整流子、６は整流子結線部であるフック、７は電機子鉄心、８は電機子鉄心端面絶縁部材、９は電機子鉄心スロット絶縁部材、１０は遠心力で電機子巻線が電機子鉄心スロットから飛び出さないよう保持する絶縁部材であるウェッジ、１１は電機子巻線を絶縁固着するワニス等の有機溶剤、１２は回転軸である。

【００１９】次に、電機子コイルの巻線形態について説明する。図１から図４に示すように、整流子片３の数が２２、電機子鉄心スロット１の数が２２の場合（これを「１スロット－１セグメント方式」という）である。２つの巻線フライヤーを持つ巻線機で、巻始めがそれぞれ対称位置にある電機子巻線２－１、２－２を同時に巻線を開始する。電機子巻線２－１は巻始めが整流子片３－１に接続し、スロット１－１及び１－１０内に巻装され、巻終わりが整流子片３－２に接続する。もう一方の電機子巻線２－２は巻始めが整流子片３－１２に接続し、スロット１－１２及び１－２１内に巻装され、巻終わりが整流子片３－１３に接続する。

【００２０】以下、同様に電機子鉄心スロット１の半周にわたり巻装し、それぞれの電機子巻線２－１は巻終わりが整流子片３－１２、電機子巻線２－２の巻終わりが整流子片３－１に接続後、端末を切断せず、電機子巻線２－１はスロット１－１２及び１－２１内に巻装され、巻終わりが整流子片３－１３に接続する。また、電機子巻線２－２はスロット１－１及び１－１０内に巻装され、巻終わりが整流子片３－２に接続する。このように、さらにもう１回電機子鉄心スロット１のさらに半周にわたり巻装し、電機子巻線２－１の最終的な巻終りが整流子片３－１に接続され、また、電機子巻線２－２の最終的な巻終りが整流子片３－１２に接続されて切断される。図において、Ｐは電機子巻線２の回転方向を示している。また、カーボンブラシ４の図示位置は電機子巻線２を構成する電機子巻線２が整流を完了する寸前に対応している。

【００２１】このように、電機子鉄心スロット１と同数の整流子片３を備えた１スロット－１セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心７の各一対のスロットに対して巻線された１本の電機子巻線２を電機子鉄心スロット１の全周（結果として２重）にわたって巻線を巻き回すことにより、２本の電機子巻線２を電機子鉄心スロット１の半周に巻線し、電機子巻線２を１重に巻き回すことと同じこととなるため、例えば、電機子巻線２の線径がφ０．４５ｍｍの場合、電機子巻線２を２重に巻回すことにより、電機子巻線２の線径が

φ０．６５ｍｍの場合に電機子巻線２を１重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。

【００２２】また、電機子巻線２の線径がφ０．４５ｍｍ以下であれば、細線であるため整流子のフック６における線間距離を安定して確保することができ、フック６に対するヒュージング不良や断線、フック６の変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。

【００２３】発明の実施の形態２

次に、この発明の実施の形態２を図について説明する。図５は界磁鉄心と電機子鉄心を上から見た図。図６は巻数比率とカーボンブラシの寿命のグラフ。図７は整流子電動機の側面図。この発明の実施の形態２は発明の実施の形態１の変形例である。図において、この発明の実施の形態１と同一の構成は同一符号を付して重複した構成の説明を省略する。１３は界磁鉄心、１４は界磁巻線、１９は整流子電動機である。図５及び図６に示すように、電機子巻線２の全導体数と界磁巻線１４の数との比率が６以上：１となるよう設定することで電機子巻線２の変圧器作用による火花抑制効果を改善でき火花発生が小さくなる。このように電機子巻線２の巻数を多くし、界磁の鉄損及び銅損を減少させることで、効率向上と整流改善により寿命を従来より１．２倍長くすることが可能となる。

【００２４】電機子巻線２の全導体数と界磁巻線１４の数との比率が６以上：１となるよう設定することにより、効率向上と整流改善が図られる理由を以下に説明する。カーボンブラシは回転体である電機子の一部分である整流子との間で電流通電を行い、発電機或いは電動機においては、カーボンブラシによって短絡されている。電機子コイルの電流が、接触期間中に電気的に電流取り出し方向を１８０度反転する際に流れる短絡電流を抑える作用を行っている。これは、電機子の各コイルが１回転毎に２回カーボンブラシで、短絡され、その都度コイル内の電流は＋１から－１へ、次には－１から－１へと方向を反転させているためで、その時間は電機子コイルがカーボンブラシで短絡された瞬間から始まり、短絡が解除される時に終わるもので、極めて短時間である。

【００２５】そして、不足整流の時には磁束の遅れがあり、電流とともに変化するリアクタンス電圧を打消しきれないためで、磁束の遅れがある限度以上になると整流の終了時に電流変化が大きくなり、ブラシの出口から火花が発生しやすくなる。また、過整流の時には不足整流と反対に磁束の進み具合が速くなり、同様な現象を起こしやすくなる。反対に最も望ましいのが短絡電流がカーボンブラシの接触面積に比例した電流分布となる直線整流の状態である。この状態を作るには、電機子巻線のインダクタンスＬと整流時間Ｔと電機子巻線抵抗Ｒの関係が、Ｌ＜ＲＴとなることで満足され、この直線整流を行うためのＲを実験にて確認した結果、図６に示したようにＲＴ全導体数／ＳＴ巻線の比率が６以上になるよう巻き線仕様を設定した時の電機子巻線抵抗Ｒを大きくすることで、整流改善ができ、効率向上と寿命を長くすることができる。

【００２６】発明の実施の形態３

次に、この発明の実施の形態３を図について説明する。図８は整流子電動機の電機子巻線の巻線配置を示す結線図、図９は位相角のズレとカーボンブラシの寿命のグラフである。この発明の実施の形態３は発明の実施の形態１の変形例である。図において、この発明の実施の形態１と同一の構成は同一符号を付して重複した構成の説明を省略する。１６は界磁極である。図８に示すように、電機子巻線２の中心と界磁極１６の中心との位相角度Ｘを１０°～３０°の間になるよう設定する。このように配置することで、回転方向の次のスロット内巻線との変圧器作用による火花抑制効果により火花発生が少なく、ブラックバー現象を抑制することができると共にブラシの寿命の向上を図ることができる。なお、図９は定格電圧１００Ｖで入力１３００Ｗの整流子電動機２１におけるカーボンブラシの寿命特性を示す。

【００２７】ここに、位相角度Ｘとは、幾何学的な中性軸Ｘ－Ｙと電気的中性軸Ｘ’－Ｙ’とがなす角度αをいい、一般には電機子の回転方向と逆方向を正としている。通常、この角度αの調整は界磁及びカーボンブラシの軸は固定しておき、整流子への電機子コイルリードの接続角度を変えることで行われている。この接続角度は通常、電機子コアスロットに対する整流子の圧入角度で調整する。この最適位相角度を実験的に求めたところ、図９に示すように１０～３０°に設定することで、流れる電流によって生じる磁束の向きが電機子巻線の変圧器作用によって火花抑制効果を期待できる位置にくるので火花発生が小さくなり、整流改善ができ、効率向上と寿命を長くすることができる。ゆえに、界磁と電機子コアスロットの中心から整流子の圧入角度をずらして設定する効果がある。

【００２８】発明の実施の形態４

次に、この発明の実施の形態４を図について説明する。図１０はこの発明の実施の形態を表す整流子電動機の巻線結線図、図１１は整流子電動機の整流子結線部部分拡大図である。図において、この発明の実施の形態１と同一の構成は同一符号を付して重複した構成の説明を省略する。次に、電機子コイルの巻線形態について説明する。図１０及び図１１に示すように、整流子片３の数が２４、電機子鉄心スロット１の数が１２の場合（これを「１スロット－２Ｎセグメント方式」という）である。

２つの巻線フライヤーを持つ巻線機で、巻始めがそれぞれ対称位置にある電機子巻線２－１、２－２を同時に巻線を開始する。電機子巻線２－１はスロット１－１及び１－６内に巻装され、巻始めが整流子片３－１に接続し、巻終りが整流子片３－２に接続する。そして、再度スロット１－１及び１－６内に巻装されて、その巻終りは整流子片３－２の隣の整流子片３－３に接続する。このような巻線方法で、順序よく巻線方向に沿って巻線を行い、電機子コイルを形成する。

【００２９】同様に電機子巻線２－２はスロット１－７及び１－１２内に巻装され、巻始めが整流子片３－１３に接続し、巻終りが整流子片３－１４に接続する。そして、再度スロット１－７及び１－１２内に巻装されて、その巻終りは整流子片３－１４の隣の整流子片３－１５に接続する。以下、同様に電機子鉄心スロット１のスロット数１２の半周にわたり巻装し、それぞれの電機子巻線２－１の巻終りが３－１３に、電機子巻線２－２の巻終りが３－１に接続後、切断せず、電機子巻線２－１はスロット１－７及び１－１２内に巻装され、巻終りが３－１４に接続する。電機子巻線２－２はスロット１－１及び１－６内に巻装され、巻終りが整流子片３－２に接続する。

【００３０】このように、さらにもう１回電機子鉄心スロット１のさらに半周にわたり巻装し、電機子巻線２－１の最終的な巻終りが整流子片３－１に接続され、また、電機子巻線２－２の最終的な巻終りが整流子片３－１３に接続されて切断される。図において、Ｐは電機子巻２線の回転方向を示している。このように、１つの電機子巻線２で２重巻線をすることで電機子巻線２を並列に巻線したことと同じ効果となるため、例えば、電機子巻線２の線径がφ０．４５ｍｍの場合、２重に巻回すことによりφ０．６５ｍｍと同等の断面積を得られる。

【００３１】このように、電機子鉄心スロット１の数に対して整流子５に２倍の整流子片３を備えた１スロット－２Ｎセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心７の各一対のスロットに対してスロット数に対して２倍の整流子片３と同じ数だけ巻線された１本の電機子巻線２を電機子鉄心スロット１の全周にわたって巻線を巻き回すことにより、スロット数は整流子片３の数の１／２倍となって実質的に１本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す１スロット－１セグメント方式の巻線形態と同じになるため、例えば、電機子巻線２の線径がφ０．４５ｍｍの場合、電機子巻線２を２重に巻回すことにより、電機子巻線２の線径がφ０．６５ｍｍの場合に電機子巻線２を１重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。

【００３２】また、電機子巻線２の線径がφ０．４５ｍｍ以下であれば、細線であるため整流子のフック６における線間距離を安定して確保することができ、フック６に対するヒュージング不良や断線、フック６の変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。なお、この発明の実施の形態４では整流子片３の数が２４、電機子鉄心スロット１の数が１２の場合について述べたが、整流子片３の数が、電機子鉄心スロット１の数の整数倍の場合には各一対のスロットに対してスロット数に対して整数倍の整流子片３と同じ数だけ巻線された１本の電機子巻線２を電機子鉄心スロット１の全周にわたって巻線を巻き回すことになる。

【００３３】発明の実施の形態５

次に、この発明の実施の形態５を図について説明する。図１２はこの発明の実施の形態を表す整流子電動機の巻線結線図である。図１３は整流子電動機の整流子結線部部分拡大図である。図１４は整流子電動機の電機子整流子部上面図である。　図において、この発明の実施の形態１と同一の構成は同一符号を付して重複した構成の説明を省略する。１７は並列巻線用電機子巻線である。次に、電機子コイルの巻線形態について説明する。図１２及び図１３に示すように、整流子片３の数が２２、電機子鉄心スロット１の数が２２の場合（１スロット－１セグメント方式）である。２つの巻線フライヤーを持つ巻線機で、１つの巻線フライヤーにより、巻始めがそれぞれ対称位置にある２本の電機子巻線２－１、１７－１と２本の電機子巻線２－２、１７－２を並列に並べて同時に巻線を開始する。

【００３４】電機子巻線２－１、１７－１は巻始めが整流子片３－１に接続し、スロット１－１及び１－１０内に巻装され、巻終りが整流子片３－２に接続する。また、電機子巻線２－２、１７－２は巻始めが整流子片３－１２に接続し、スロット１－１２及び１－２１内に巻装され、巻終りが整流子片３－１３に接続する。以下、同様に電機子鉄心スロット１の半周にわたり巻装し、それぞれの電機子巻線２－１、１７－１の巻終りが３－１２、それぞれの電機子巻線２－２、１７－２の巻終りが３－１に接続されるよう巻線する。

【００３５】このように、電機子鉄心スロット１と同数の整流子片３を備えた１スロット－１セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心７の各一対のスロットに対して巻線された２本並列にした電機子巻線２を電機子鉄心スロット１の半周にわたって巻線することにより、実質的に１本の電機子巻線２を電機子鉄心スロット１の全周にわたって巻線を巻き回す１スロット－１セグメント方式の巻線形態と同じになるため、例えば、電機子巻線２の線径がφ０．４５ｍｍの場合、電機子巻線２を２重に巻き回すことにより、電機子巻線

２の線径がφ０．６５ｍｍの場合に電機子巻線２を１重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。

【００３６】また、電機子巻線２の線径がφ０．４５以下であれば、細線であるため整流子のフック６における線間距離を安定して確保することができ、フック６に対するヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。

【００３７】発明の実施の形態６

次に、この発明の実施の形態６を図について説明する。図１５はこの発明の実施の形態を表す整流子電動機の巻線結線図である。図１６は整流子電動機の整流子結線部部分拡大図である。この発明の実施の形態１と同一の構成は同一符号を付して重複した構成の説明を省略する。次に、電機子コイルの巻線形態について説明する。図１５及び図１６に示すように、整流子片３の数が２４、電機子鉄心スロット１の数が１２の場合（１スロット－２Ｎセグメント方式）である。２つの巻線フライヤーを持つ巻線機で、１つの巻線フライヤーにより、巻始めがそれぞれ対称位置にある２本の電機子巻線２－１、１７－１と２本の電機子巻線２－２、１７－２を並列に並べて同時に巻線を開始する。

【００３８】電機子巻線２－１、１７－１はスロット１－１及び１－６内に巻装され、巻始めが整流子片３－１に接続し、巻終りが整流子片３－２に接続する。そして、再度スロット１－１及び１－６内に巻装されて、その巻終りは整流子片３－２の隣の整流子片３－３に接続する。このように、電機子巻線２－１、１７－１が電機子コイルを形成する。同様に電機子巻線２－２、１７－２はスロット１－７及び１－１２内に巻装され、巻始めが整流子片３－１３に接続し、巻終りが整流子片３－１４に接続する。そして、再度スロット１－７及び１－１２内に巻装されて、その巻終りは整流子片３－１４の隣の整流子片３－１５に接続する。以下、同様に電機子鉄心スロット１のスロット数１２の半周にわたり巻装し、それぞれの電機子巻線２－１、１７－１の巻終りが３－１３に、２－２、１７－２の巻終りが３－１に接続されるよう巻線する。

【００３９】このように、電機子鉄心スロット１の数に対して整流子５に２倍の整流子片３を備えた１スロット－２Ｎセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心７の各一対のスロットに対してスロット数に対して２倍の整流子片３と同じ数だけ巻線された２本の電機子巻線２を電機子鉄心のスロット１の全周にわたって巻線を巻き回すことにより、スロット数は整流子片３の数の１／２倍となって実質的に１本の電機子巻線２を電機子鉄心スロット１の全周にわたって巻線を巻き回す１スロット－１セグメント方式の巻線形態と同じになるため、例えば、電機子巻線２の線径がφ０．４５ｍｍの場合、電機子巻線２を２重に巻き回すことにより、電機子巻線２の線径がφ０．６５ｍｍの場合に電機子巻線２を１重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができる。

【００４０】また、電機子巻線２の線径がφ０．４５ｍｍ以下であれば、細線であるため整流子のフック６における線間距離を安定して確保することができ、フック６に対するヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる。なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなる。なお、この発明の実施の形態６では整流子片３の数が２４、電機子鉄心スロット１の数が１２の場合について述べたが、整流子片３の数が電機子鉄心スロット１の数の整数倍の場合には各一対のスロットに対してスロット数に対して整数倍の整流子片３と同じ数だけ巻線された本数の電機子巻線を電機子鉄心のスロット１の全周にわたって巻線を巻き回すことになる。

【００４１】発明の実施の形態７

次にこの発明の実施の形態７を図について説明する。図１７はこの発明の実施の形態を表す整流子電動機の巻線結線図、図１８は整流子電動機の整流子結線部部分拡大図、図１９は整流子電動機の電機子整流子部上面図である。図において、この発明の実施の形態１と同一の構成は同一符号を付して重複した構成の説明を省略する。次に、電機子コイルの巻線形態について説明する。図１７から図１９に示すように、整流子片３の数が２２、電機子鉄心スロット１の数が２２の場合（１スロット－１セグメント方式）である。

【００４２】２つの巻線フライヤーを持つ巻線機で、巻始めがそれぞれ対称位置にある電機子巻線２－１、２－２を同時に巻線を開始する。電機子巻線２－１は巻始めが整流子片３－１に接続し、スロット１－１及び１－１０内に巻装され、巻終りが整流子片３－２に接続する。電機子巻線２－２は巻始めが整流子片３－１２に接続し、スロット１－１２及び１－２１内に巻装され、巻終りが整流子片３－１３に接続する。以下、同様に電機子鉄心スロット１の半周にわたり巻装し、それぞれの電機子巻線２－１の巻終りが３－１２、２－２の巻終りが３－１に接続後、一端切断する。

【００４３】次に、切断したところから回転方向に数えて２セグメント位置をずらしたところから電機子巻線２

－１、２－２に相当する２－３、２－４を１回目と同様、同時に巻線を開始する。電機子巻線２－３は巻始めが整流子片３－３に接続し、スロット１－３及び１－１２内に巻装され、巻終りが整流子片３－４に接続する。電機子巻線２－４は巻始めが整流子片３－１４に接続し、スロット１－１４及び１－１内に巻装され、巻終りが整流子片３－１５に接続する。以下、同様に電機子鉄心スロット１のさらに半周にわたり巻装し、それぞれの電機子巻線２－３の巻終りが３－１４に、電機子巻線２２－４の巻終りが３－３に接続する。

【００４４】このように、電機子鉄心スロット１と同数の整流子片３を備えた１スロット－１セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心７の各一対のスロットに対して巻線された１本の電機子巻線２を互いに電機子鉄心スロット１の半周ずつ全周にわたって巻線する際に、残りの半周の巻始めをそれから所定位置ずらしたところから開始し、ずらせた位置からＮ／２個目の対スロットまで順次巻線することにより、請求項１で述べた方式と同じ効果を得ることができ、さらに１つのスロット内における１回目と２回目の巻線バランスがよくなり、電機子の初期アンバランスを３０％削減でき、電機子バランス修正の改善につながる。

【００４５】発明の実施の形態８

次に、この発明の実施の形態８を図について説明する。図２０はこの発明の実施の形態を表す整流子電動機の電機子整流子部上面図である。図において、この発明の実施の形態１と同一の構成は同一符号を付して重複した構成の説明を省略する。発明の実施の形態７では、２回目となる残りの半周の巻始めをそれから２セグメント位置をずらしたところから開始していたが、この発明の実施の形態８では、２回目の巻線開始位置を次の整流子片３から数えて６０°～１２０°先の整流子片３から巻始める。巻き方は発明の実施の形態７と同じであるため具体的説明は省略する。このような電機子巻線の巻線方法により前項に述べた方式と同じ効果を得ることができ、また、２回目の巻線を９０°±αから巻線を殆めているため、電機子の初期アンバランスを約３０％削減でき、電機子バランス修正の改善につながる。

【００４６】発明の実施の形態９

次に、この発明の実施の形態９を図について説明する。図２１はこの発明の実施の形態を表す巻数比率と寿命のグラフ、図２２は巻数仕様と入力のグラフ、図２３は電機子巻線が巻線された電機子鉄心スロット部の切断拡大図である。図において、この発明の実施の形態１と同一の構成は同一符号を付して重複した構成の説明を省略する。この発明の実施の形態９は、発明の実施の形態１及び７のように、電機子鉄心スロット１と同数の整流子片３を備えた１スロット－１セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心７の各一対のスロットに対して巻線された１本の電機子巻線２を互いに電機子鉄心スロット１の半周ずつ全周にわたって巻線する（即ち、各一対のスロットに対して１本の電機子巻線が二重巻きする）場合に、対スロット内の巻線で１回目と２回目の巻線抵抗がほぼ同じになるように巻数が１回目＞２回目となり、その比率が１．１～１．４となるよう設定する。

【００４７】このように設定することにより、請求項１で述べた方式と同じ効果を得ることができ、さらに１回目と２回目における巻線形状及び巻線抵抗が均一となり整流バランスが改善できるので、図２２に示すとおり寿命の改善も期待できる。また、今までどおり１回巻、もしくは１回目と２回目の巻数が同数の仕様では巻数は１×８Ｔ、１×９Ｔと整数値でしか表すことができなかったが、図２３に示すとおり１回目と２回目の巻数仕様を変えることで１×８．５Ｔ、１×９．５Ｔと巻線仕様の巾を広げることができることで、入力の調整を巻線仕様にて行う際、従来に比べ大変有利となる。

【００４８】発明の実施の形態１０

次に、この発明の実施の形態１０について説明する。図２４はこの発明の実施の形態を表す整流子電動機の巻線結線図、図２５は整流子電動機の整流子線部部分拡大図である。図において、この発明の実施の形態１と同一の構成は同一符号を付して重複した構成の説明を省略する。次に、電機子コイルの巻線形態について説明する。図２４及び図２５に示すように、整流子片３の数が２４、電機子鉄心スロット１の数が１２の場合（１スロット－２Ｎセグメント方式）である。

【００４９】２つの巻線フライヤーを持つ巻線機で、巻始めがそれぞれ対称位置にある電機子巻線２－１、２－２を同時に巻線を開始する。電機子巻線２－１はスロット１－１及び１－６内に巻装され、巻始めが整流子片３－１に接続し、巻終りが整流子片３－２に接続する。そして、再度スロット１－１及び１－６内に巻装されて、その巻終りは整流子片３－２の隣の整流子片３－３に接続する。このような巻線方法で、順序よく巻線方向に沿って巻線を行い、電機子コイルを形成する。同様に電機子巻線２－２はスロット１－７及び１－１２内に巻装され、巻始めが整流子片３－１３に接続し、巻終りが整流子片３－１４に接続する。そして、再度スロット１－７及び１－１２内に巻装されて、その巻終りは整流子片３－１４の隣の整流子片３－１５に接続する。以下、同様に電機子鉄心スロット１のスロット数１２の半周にわたり巻装し、それぞれの電機子巻線２－１の巻終りが３－１３に、２－２の巻終りが３－１に接続後、一旦切断する。

【００５０】次に、切断したところから、回転方向に数えて２セグメント位置をずらしたところから、電機子巻線２－１、２－２を１回目と同様、同時に巻き線を開始する。電機子巻線２－１はスロット１－７及び１－１２内に巻装され、巻終りが３－１４に接続する。電機子巻

線２－２はスロット１－１及び１－６内に巻装され、巻終りが整流子片３－２に接続する。このように、さらにもう１回電機子鉄心スロット１のスロット数１２のさらに半周にわたり巻装し、電機子巻線２－１の最終的な巻終りが整流子片３－１に接続され、また、電機子巻線２－２の最終的な巻終りが整流子片３－１３に接続されて切断される。

【００５１】このように、電機子鉄心スロット１の数に対して整流子５に２倍の整流子片３を備えた１スロット－２Ｎセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心７の各一対のスロットに対してスロット数に対して２倍の整流子片３と同じ数だけ巻線された１本の電機子巻線２を互いに電機子鉄心スロット１の半周ずつ全周にわたって巻線する際に、残りの半周の巻始めをそれから２セグメント位置をずらしたところから開始し、ずらせた位置からＮ／２個目の対スロットまで順次巻線することにより、請求項１で述べた方式と同じ効果を得ることができ、さらに１つのスロット内における１回目と２回目の巻線バランスがよくなり、電機子の初期アンバランスを３０％削減でき、電機子バランス修正の改善につながる。

【００５２】発明の実施の形態１１

次に、この発明の実施の形態１１を図について説明する。発明の実施の形態１０では、２回目となる残りの半周の巻始めをそれから２セグメント位置をずらしたところから開始していたが、この発明の実施の形態１１では、２回目の巻線開始位置を次の整流子片３から数えて６０°～１２０°先の整流子片３から巻始める。巻き方は発明の実施の形態１０と同じであるため具体的説明は省略する。このような電機子巻線の巻線方法により前項に述べた方式と同じ効果を得ることができ、また、２回目の巻線を９０°±αから巻線を殆めているため、電機子の初期アンバランスを約３０％削減でき、電機子バランス修正の改善につながる。さらに、巻線形状及び巻線抵抗が均一となり整流バランスが改善できるので寿命の改善も期待できる。

【００５３】発明の実施の形態１２

この発明の実施の形態１２は、発明の実施の形態４及び１０のように、電機子鉄心スロット１の数に対して整流子５に２倍の整流子片３を備えた１スロット－２Ｎセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心７の各一対のスロットに対して巻線された１本の電機子巻線２を互いに電機子鉄心スロット１の半周ずつ全周にわたって巻線する（即ち、各一対のスロットに対して１本の電機子巻線が二重巻きする）場合に、対スロット内の巻線で１回目と２回目の巻線抵抗がほぼ同じになるように巻数が１回目＞２回目となり、その比率が１．１～１．４となるよう設定する。

【００５４】このように設定することにより、請求項１で述べた方式と同じ効果を得ることができ、さらに１回目と２回目における巻線形状及び巻線抵抗が均一となり整流バランスが改善できるので、図２２に示すとおり寿命の改善も期待できる。また、今までどおり１回巻、もしくは１回目と２回目の巻数が同数の仕様では巻数は１×８Ｔ、１×９Ｔと整数値でしか表すことができなかったが、１回目と２回目の巻数仕様を変えることで１×８．５Ｔ、１×９．５Ｔと巻線仕様の巾を広げることができることで、入力の調整を巻線仕様にて行う際、従来に比べ大変有利となる。上述した発明の実施の形態ではいずれもα－フック方式の整流子について説明したが、スタフィング方式（電機子巻線の結線を整流子上に設けられた溝に打ち込んで固定する方式）の整流子について適用できることはいうまでもない。

【００５５】

【発明の効果】以上のように、この発明の請求項１の整流子電動機においては、電機子鉄心のスロットと同数の整流子片を備えた１スロット－１セグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一対のスロットに対して巻線された１本の電機子巻線を電機子鉄心のスロット全周（結果として２重）にわたって巻線を巻き回すことにより、２本の電機子巻線を電機子鉄心のスロット半周に巻線し、電機子巻線を１重に巻回すことと同じこととなるため、例えば、電機子巻線の線径がφ０．４５ｍｍの場合、電機子巻線を２重に巻回すことにより、電機子巻線の線径がφ０．６５ｍｍの場合に電機子巻線を１重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができるという効果を奏する。また、電機子巻線の線径がφ０．４５ｍｍ以下であれば、細線であるため整流子フック部の線間距離を安定して確保することができ、ヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる、なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなるという効果を奏する。

【００５６】この発明の請求項２の整流子電動機においては、電機子全導体数と界磁巻線数との比率が６以上：１となるよう設定することにより、電機子巻線の変圧器作用による火花抑制効果を改善できるため、電機子巻線の巻数を多くし、界磁の鉄損及び銅損を減少させることで、効率向上と整流改善により寿命を従来より１．２倍長くすることが可能となる効果を奏する。

【００５７】この発明の請求項３の整流子電動機においては、電機子巻線の中心と界磁極の中心との位相角度を１０°～３０°の間になるよう設定することにより、回転方向の次の電機子鉄心スロット内巻線との変圧器作用による火花抑制効果により火花発生が少なく、ブラックバー現象を抑制することができるとともに刷子寿命の向

上を図ることができるという効果を奏する。

【００５８】この発明の請求項４の整流子電動機においては、電機子鉄心のスロットの数に対して整流子に２倍以上の整数倍の整流子片を備えた１スロット－２Ｎセグメント方式で、巻始めがそれぞれ対称位置にある電機子鉄心の各一対のスロットに対してスロット数に対して整数倍の整流子片と同じ数だけ巻線された１本の電機子巻線を電機子鉄心のスロット全周（結果としてスロット数に対して整数倍重）にわたって巻線を巻き回すことにより、スロット数は整流子片の数の１／整数倍となって実質的に１本の電機子巻線を電機子鉄心のスロット全周にわたって巻線を巻き回す１スロット－１セグメント方式の巻線形態と同じになるため、１スロット－２Ｎセグメント方式でも、請求項１で述べた１スロット－１セグメント方式と同じように、例えば、電機子巻線の線径がφ０．４５ｍｍの場合、電機子巻線を２重に巻回すことにより、電機子巻線の線径がφ０．６５ｍｍの場合に電機子巻線を１重に巻回すものと同等の断面積を得られるので、太線を巻いて得られる銅損改善の効果と同等のものを得ることができるという効果を奏する。また、電機子巻線の線径がφ０．４５ｍｍ以下であれば、細線であるため整流子フック部の線間距離を安定して確保することができ、ヒュージング不良や断線、フックの変形や巻線加工劣化等、品質上の問題点を解決することができ、さらに細線を巻線するので巻線の剛性を弱くでき、その結果、巻径を小さくすることが可能となるので、製造上の不具合を改善できる、なお且つ、接続後の線間距離を目視確認する必要がなくなり、工数削減による生産性向上にもなるという効果を奏する。

【図面の簡単な説明】

【図１】　この発明の実施の形態１を表す整流子電動機の巻線結線図である。

【図２】　この発明の実施の形態１を表す整流子電動機の電機子整流子部上面図である。

【図３】　この発明の実施の形態１を表す整流子結線側面図である。

【図４】　この発明の実施の形態１を表す整流子結線部部分拡大図である。

【図５】　この発明の実施の形態２を表す界磁鉄心と電機子鉄心を上から見た図である。

【図６】　この発明の実施の形態２を表す巻数比率とカーボンブラシの寿命のグラフである。

【図７】　この発明の実施の形態２を表す整流子電動機の側面図である。

【図８】　この発明の実施の形態３を表す電機子巻線の巻線配置を示す結線図である。

【図９】　この発明の実施の形態３を表す位相角のズレとブラシの寿命のグラフである。

【図１０】　この発明の実施の形態４を表す整流子電動機の巻線結線図である。

【図１１】　この発明の実施の形態４を表す整流子結線部部分拡大図である。

【図１２】　この発明の実施の形態５を表す整流子電動機の巻線結線図である。

【図１３】　この発明の実施の形態５を表す整流子結線部部分拡大図である。

【図１４】　この発明の実施の形態５を表す電機子整流子部上面図である。

【図１５】　この発明の実施の形態６を表す整流子電動機の巻線結線図である。

【図１６】　この発明の実施の形態６を表す整流子結線部部分拡大図である。

【図１７】　この発明の実施の形態７を表す整流子電動機の巻線結線図である。

【図１８】　この発明の実施の形態７を表す整流子結線部部分拡大図である。

【図１９】　この発明の実施の形態７を表す電機子整流子部上面図である。

【図２０】　この発明の実施の形態８を表す電機子整流子部上面図である。

【図２１】　この発明の実施の形態９を表す巻数比率と寿命のグラフである。

【図２２】　この発明の実施の形態９を表す巻数仕様と入力のグラフである。

【図２３】　この発明の実施の形態９を表す電機子巻線が巻線された電機子鉄心スロット部の切断拡大図である。

【図２４】　この発明の実施の形態１０を表す整流子電動機の巻線結線図である。

【図２５】　この発明の実施の形態１０を表す整流子結線部部分拡大図である。

【図２６】　従来の整流子電動機の巻線結線図である。

【図２７】　従来の整流子電動機の電機子側面図である。

【図２８】　従来の整流子電動機の電機子鉄心スロット切断面図である。

【図２９】　従来の整流子電動機の整流子結線部部分拡大図である。

【図３０】　従来の界磁鉄心と電機子鉄心を上から見た図である。

【図３１】　従来の整流子電動機の電機子整流子部上面図である。

【図３２】　従来の整流子電動機の電機子整流子部側面図である。

【図３３】　従来の整流子電動機の電機子整流子部下面図である。

【図３４】　図３３の部分拡大図である。

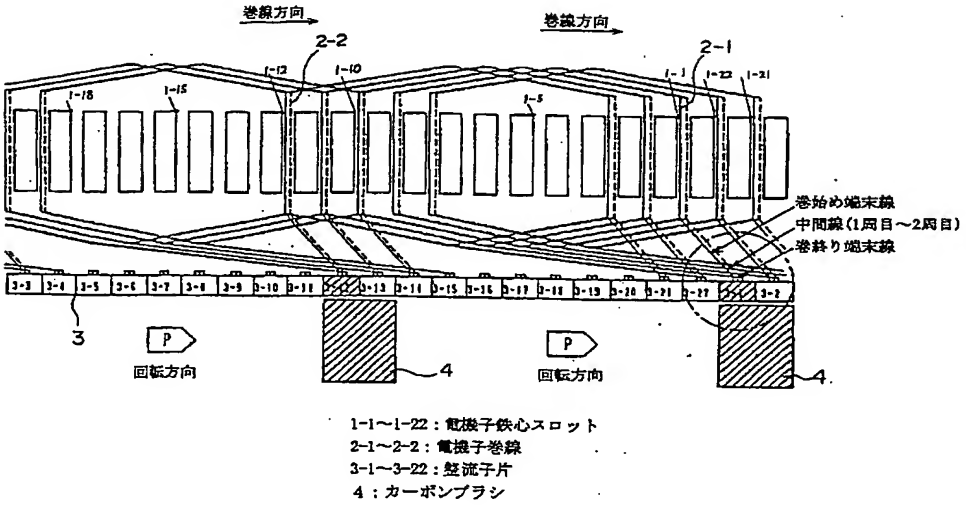
【図３５】　電機子巻線を行うフライヤー巻線機の巻線投入部の図である。

【符号の説明】

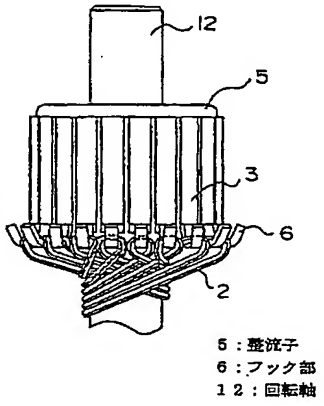
19　　20

１　電機子鉄心スロット、２　電機子巻線、３　整流子片、５　整流子、７電機子鉄心、１２　回転軸、１３　界磁鉄心、１４　界磁巻線、１９　整流子電動機。

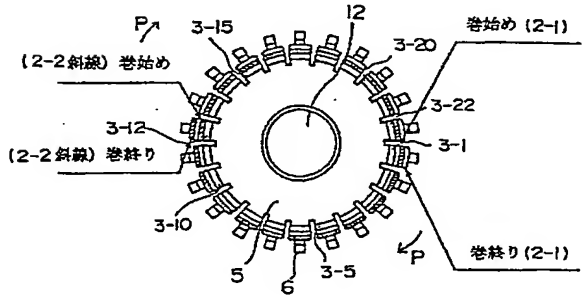
【図１】



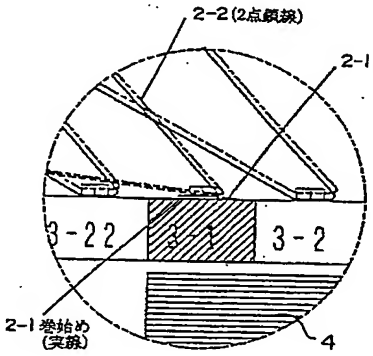
【図３】



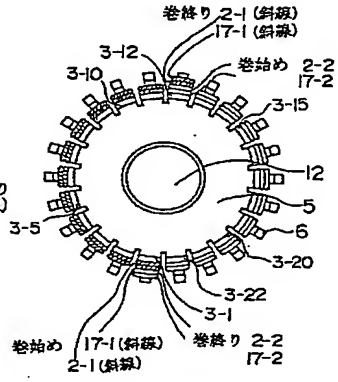
【図２】



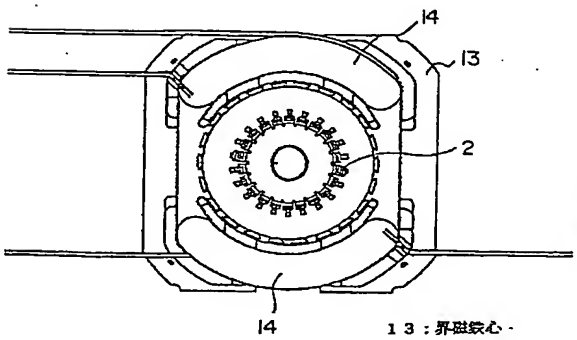
【図４】



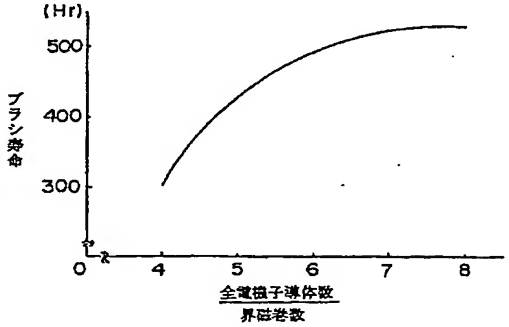
【図１４】



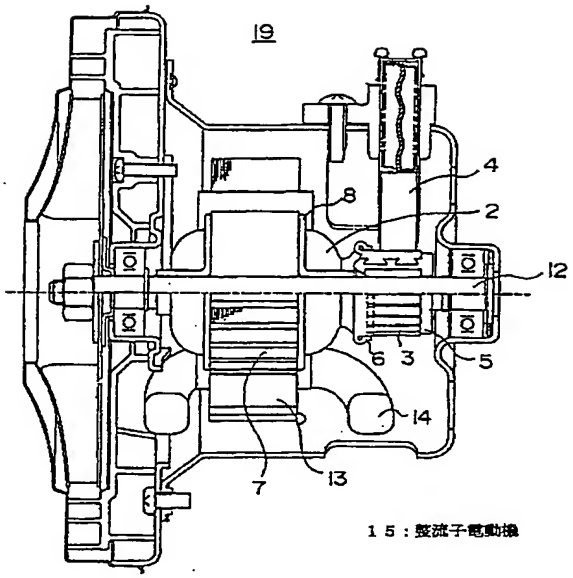
【図５】



【図６】

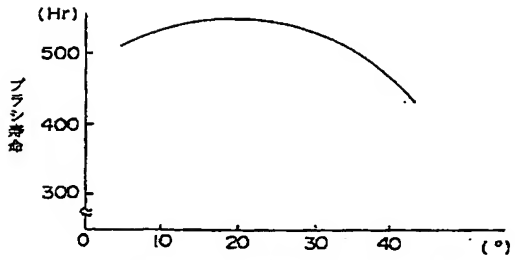


【図７】



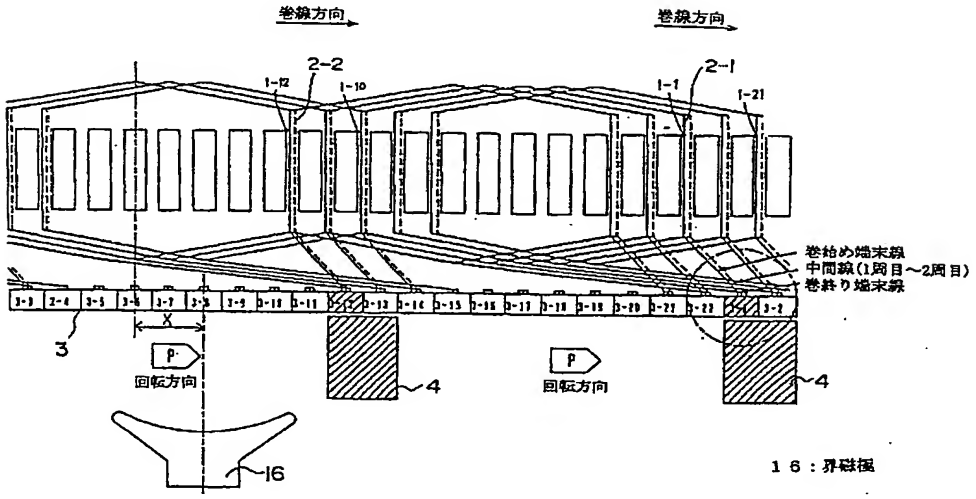
１５：整流子電動機

【図９】



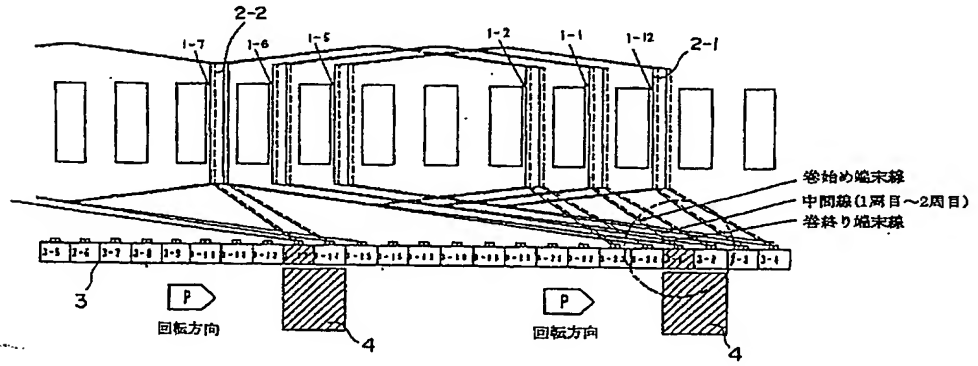
電機子巻線の中心と界磁極の中心とのズレ角度（X）

【図８】

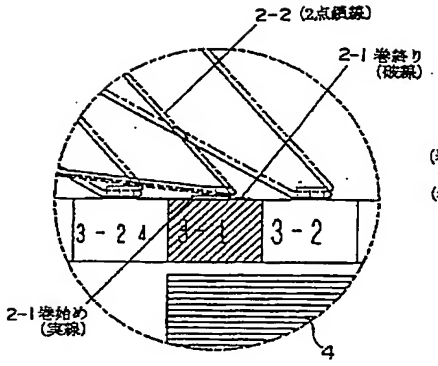


１６：界磁極

【図１０】



【図１１】



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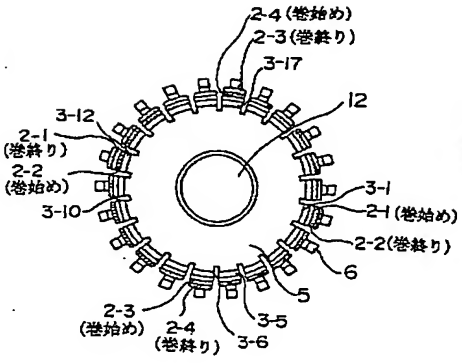

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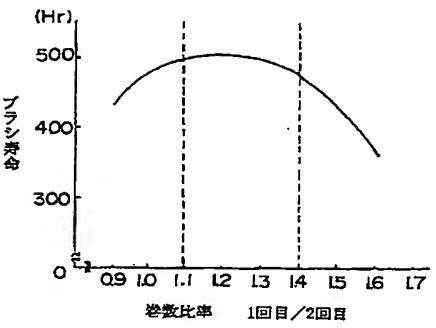

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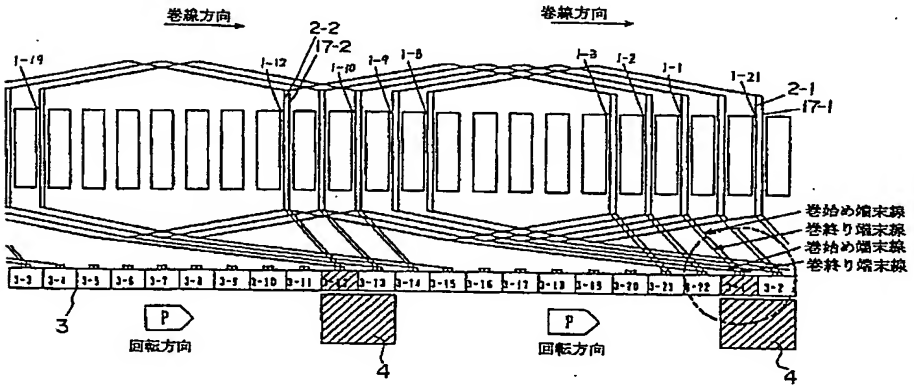
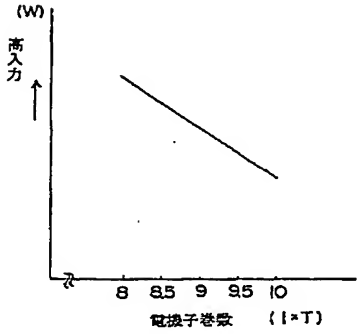


17-1～17-2：電機子巻線（並列用）

【図２２】



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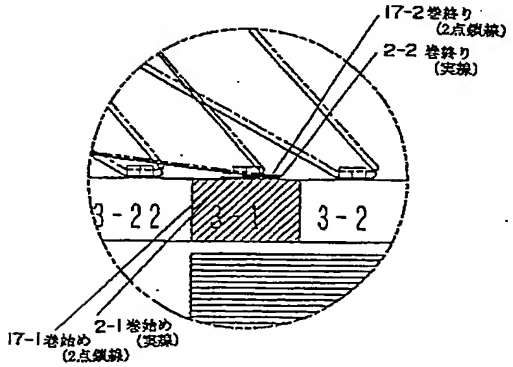

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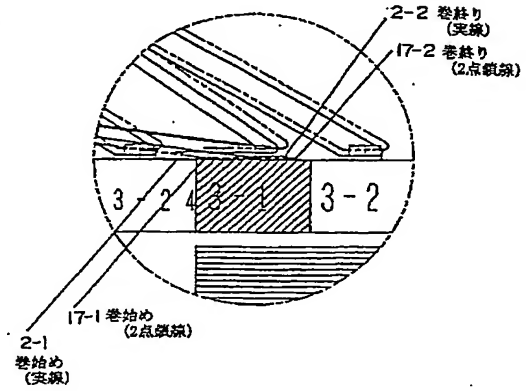

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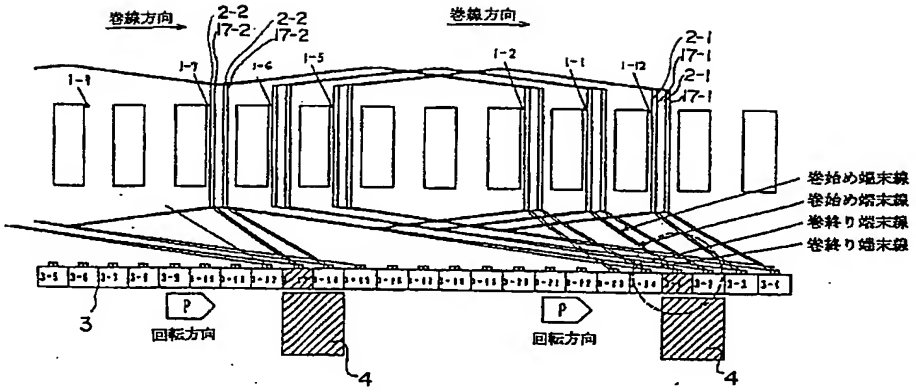

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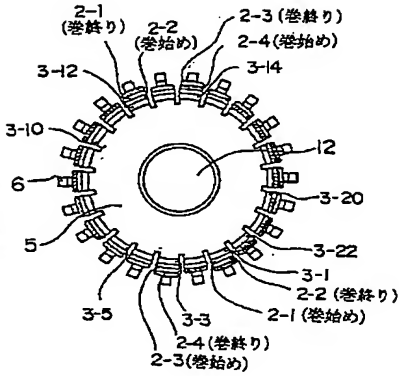

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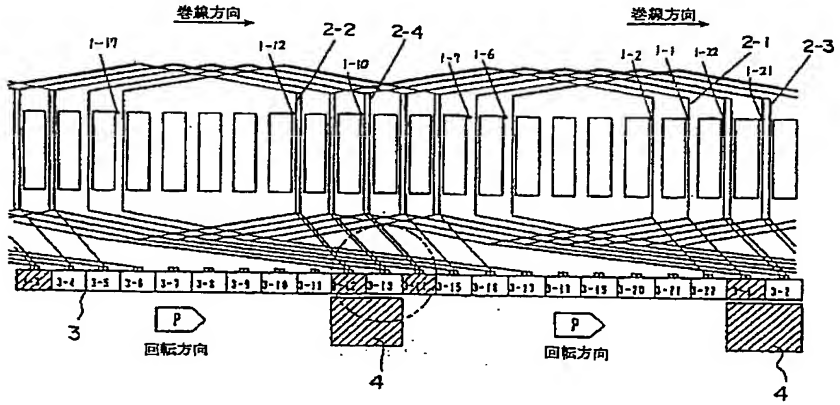

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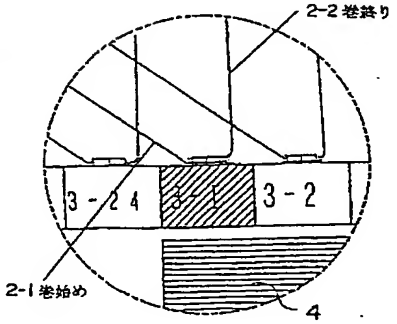

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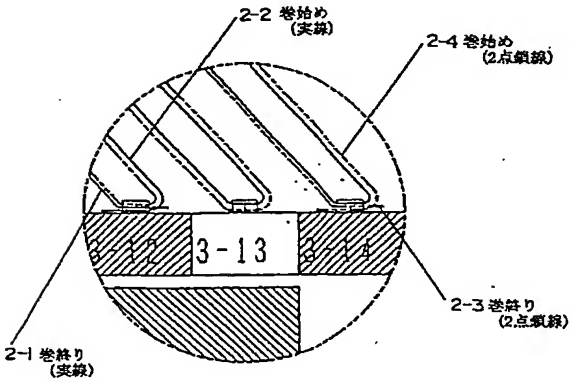

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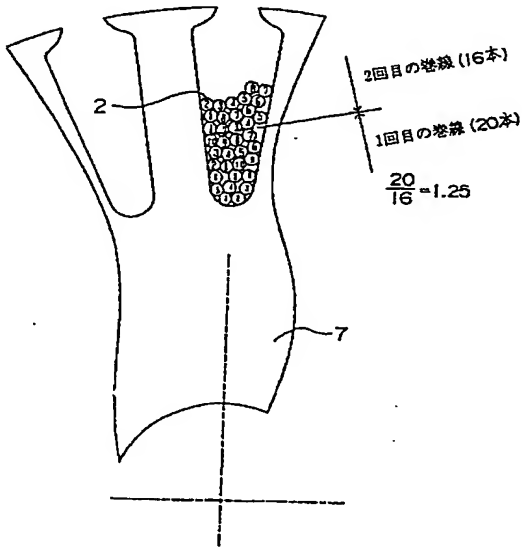

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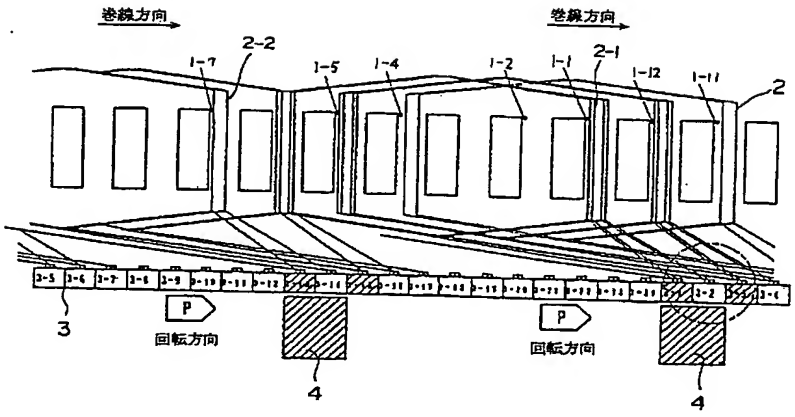

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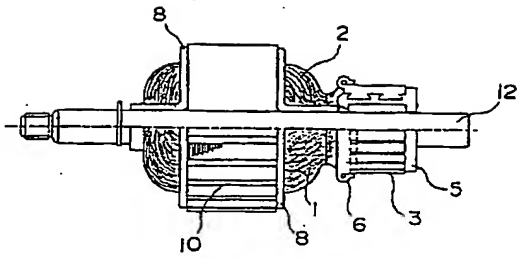
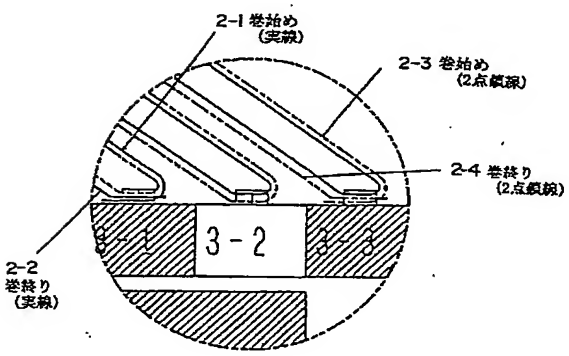


8：電機子鉄心端面絶縁部材
１０：絶縁部材（ウェッジ）

【図２５】



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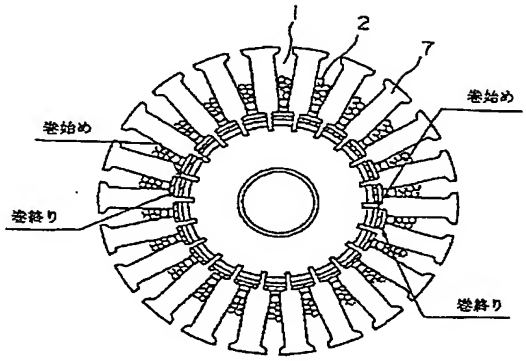

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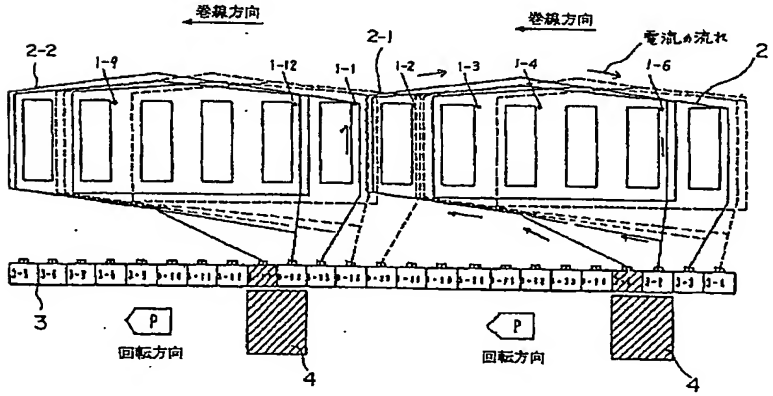
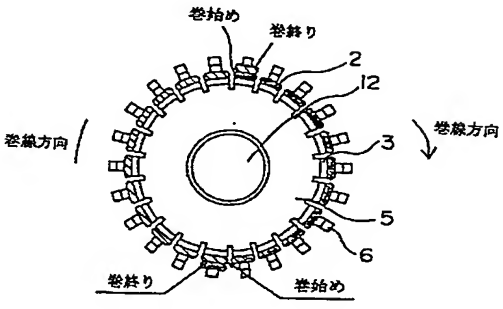


【図３１】



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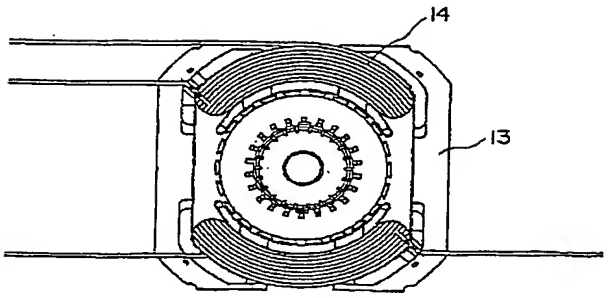

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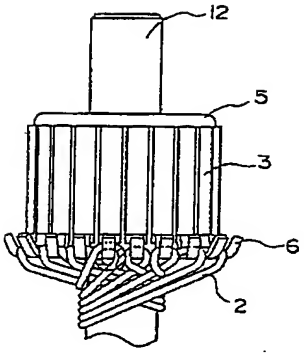

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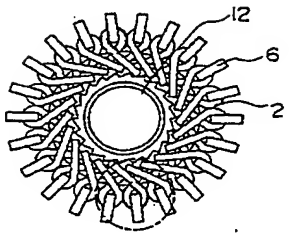

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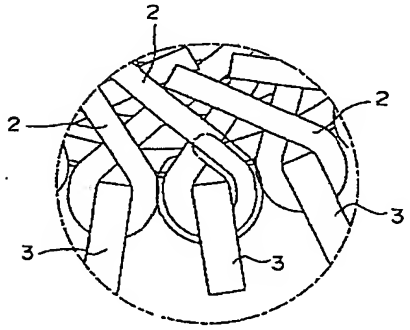

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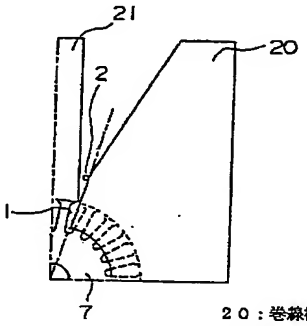

２０：巻線機フォーム
２１：巻線機センタガイド

フロントページの続き

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